NAS 1.9/4:24/18

VOLUME 24 / NUMBER 18
SEPTEMBER 23, 1986
ACC. NOS. N86-27178 TO N86-28047

Redstone
BIOLOGY AND SCIENCE
DEI PUBLIC LIBRARY

STAR

AN ABSTRACT JOURNAL

Scientific and Technical Aerospace Reports

Detroit Public Library
SEP 11 1986
Acquisitions Department

PRODUCED BY THE
SCIENTIFIC AND TECHNICAL
INFORMATION
BRANCH

NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WHAT YOU CAN DO FOR *STAR*

All users of this abstract service are urged to forward reports to be considered for announcement in *STAR*. This will aid NASA in its efforts to provide the fullest possible coverage of all scientific and technical publications that might support aeronautics and space research and development. If you have prepared relevant reports (other than those that you will transmit to NASA, DoD, or DOE through the usual contract- or grant-reporting channels), please send them for consideration to the NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Maryland 21240.

Reprints of journal articles, book chapters, and conference papers are also welcome. These will be considered for announcement in *STAR's* companion journal, *International Aerospace Abstracts*.

You may specify a particular source to be included in a report announcement if you wish; otherwise the report will be placed on public sale at the National Technical Information Service. Copyrighted publications will be announced but not distributed or sold.

PURCHASE OF *STAR*

The semimonthly issues are available for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

PUBLISHED BY:

UNITED STATES GOVERNMENT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
SCIENTIFIC AND TECHNICAL INFORMATION BRANCH
Scientific and Technical Aerospace Reports, Volume 24, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by RMS Associates.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through March 22, 1988.

US ISSN 0036-8741

INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institutions, universities, and private firms
- Translations in report form
- NASA-owned patents and patent applications
- Dissertations and theses

Cumulative index volumes are published annually.

Journal, book, and conference literature, cover-to-cover journal translations, and certain foreign dissertations are announced in a companion journal, *International Aerospace Abstracts (IAA)*, available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 555 West 57th Street, 12th Floor, New York, New York 10019.

SUBJECT SCOPE

Subject scope of *STAR*, and *IAA* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

OTHER NASA PUBLICATIONS

Other NASA publications and information services are described in the publication, *The NASA Scientific and Technical Information System ... and How to Use It*, available without charge from the NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Maryland 21240.

Detroit Public Library

SEP 11 1986

Depository Document

HOW TO USE *STAR* SUBJECT CATEGORIES

STAR is categorized by 10 major subject divisions divided into 74 specific subject categories and one general category/division. The major subject divisions are listed in the Table of Contents, together with a note for each that defines its scope and provides any cross-references. For example:

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

CROSS-REFERENCES

Individual *STAR* abstracts are not ordinarily cross-referenced, except for certain conference reports or book translations that have had separate abstracts written for their component papers or chapters. Citations and abstracts of the components follow immediately after those of the parent document. When the subject content of a component differs sufficiently from the general content of the parent, a cross-reference citation also is printed at the end of the category to which it normally would have been assigned if it were independent.

DOCUMENTS ON MICROFICHE

Documents on microfiche[1] are designated by a pound sign (#) following the accession number. The pound sign is used without regard to the source or quality of the microfiche.

AVAILABILITIES

One or more sources from which a document announced in *STAR* is available to the public is given in each citation. The most commonly indicated sources and their acronyms or abbreviations are listed below. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source line.

(1) A microfiche is a transparent sheet of film, 105 by 148 mm in size, containing as many as 60 to 98 pages of information reduced to micro images (not to exceed 26:1 reduction).

Avail: NTIS. Sold by the National Technical Information Service. Prices for hard copy (HC) and microfiche (MF) are indicated by a price code following the letters HC or MF in the *STAR* citation. Current values for the price codes are given in the tables on page vii.

Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) is available at greatly reduced unit prices. For this service and for information concerning subscription to NASA printed reports, consult the NTIS Subscription Section, Springfield, Va. 22161.

NOTE ON ORDERING DOCUMENTS: When ordering NASA publications (those followed by the * symbol), use the N accession number. NASA patent applications (only the specifications are offered) should be ordered by the US-Patent-Appl-SN number. Non-NASA publications (no asterisk) should be ordered by the AD, PB, or other *report* number shown on the last line of the citation, not by the N accession number. It is also advisable to cite the title and other bibliographic identification.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy. The current price and order number are given following the availability line. (NTIS will fill microfiche requests, as indicated above, for those documents identified by a # symbol.)

Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Adminstration, Public Documents Room (Room 126), 600 Independence Ave., S.W., Washington, D.C. 20546, or public document rooms located at each of the NASA research centers, the NASA Space Technology Laboratories, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Department of Energy reports, usually in microfiche form, are listed in *Energy Research Abstracts*. Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center - Its' Functions and Services* (TID-4660), which may be obtained without charge from the DOE Technical Information Center.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from *Dissertation Abstracts* and are sold by University Microfilms as xerographic copy (HC) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed in this Introduction. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, California. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)

Avail: Fachinformationszentrum, Karlsruhe. Sold by the Fachinformationszentrum Energie, Physik, Mathematik GMBH, Eggenstein Leopoldshafen, Federal Republic of Germany, at the price shown in deutschmarks (DM).

Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

Avail: US Patent and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of $1.50 each, postage free. (See discussion of NASA patents and patent applications below.)

Avail: ESDU. Pricing information on specific data, computer programs, and details on ESDU topic categories can be obtained from ESDU International Ltd. Requesters in North America should use the Virginia address while all other requesters should use the London address.

Avail: (US Sales Only). These foreign documents are available to users within the United States from the National Technical Information Service (NTIS). They are available to users outside the United States through the International Nuclear Information Service (INIS) representative in their country, or by applying directly to the issuing organization.

NASA PATENTS AND PATENT APPLICATIONS

Patents and patent applications owned by NASA are announced in *STAR* under appropriate subject categories and are referenced in the *STAR* indexes. In the Report/Accession Number Index, patents are indexed by the NASA Case Number (which appears in lieu of the report number in other indexes), the U.S. Patent Number, the U.S. Patent Application Serial Number, and the U.S. Patent Class. Patent applications for which patents have not yet been issued are indexed by the NASA Case Number and the U.S. Patent Application Serial Number.

NASA *patent application specifications* are sold in paper copy by the National Technical Information Service at price code A02. Microfiche are sold at price code A01. The US-Patent-Appl-SN- number should be used in ordering either paper copy or microfiche from NTIS. Printed copies of *patents* (which are not microfiched) are available for purchase at $1.50 per copy from:

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, D.C. 20231

When ordering patents, the U.S. Patent Number should be used, and payment must be remitted in advance, preferably by money order or check payable to the Commissioner of Patents and Trademarks. Prepaid purchase coupons for ordering are also available from the Patent and Trademark Office. The patents and patent applications announced in *STAR* are owned by NASA and are available for royalty-free licensing. Requests for licensing terms and further information should be addressed to:

Assistant General Counsel for Patent Matters/Code GP
National Aeronautics and Space Administration
Washington, D.C. 20546

ELIGIBILITY AND REGISTRATION FOR NASA INFORMATION PRODUCTS AND SERVICES

A variety of services is available to organizations of the following types that have registered with NASA to receive specific services or products:

1. NASA offices, research centers, contractors, subcontractors, grantees, and consultants;
2. Other U.S. Government agencies and their contractors;
3. Libraries in the United States that have arrangements with NASA to maintain collections of NASA documents for public reference;
4. Other organizations in the United States having a need for NASA documents in work related to aeronautics and space research;
5. Organizations abroad that have established reciprocal document exchange arrangements with NASA.

Only the central service points or central points of document acquisition and control within qualified organizations are eligible to register for NASA products and services. Domestic organizations that may be eligible to receive various classes of NASA publications and services should address their requests for registration or for further information to:

NASA Scientific and Technical Information Facility
ATTN: Registration Activity
P.O. Box 8757
B.W.I. Airport, Maryland 21240

Organizations abroad should direct requests to the same address, but to the attention of: International Exchange Program.

AVAILABILITY OF *STAR* ABSTRACTS ON MICROFICHE

Microfiche of the abstract sections of this issue and other issues of *STAR* are available on annual subscription from NTIS, Attn: Subscriptions, 5285 Port Royal Road, Springfield, Virginia 22161. Annual subscription rates are $70.00 North America; $140.00 foreign. Abstract sections for previous years retroactive to 1964 are available at the current rates. Microfiche for individual *STAR* issue abstract sections are not available.

PUBLIC COLLECTIONS OF NASA DOCUMENTS

DOMESTIC: NASA and NASA-sponsored documents and a large number of aerospace publications are available to the public for reference purposes at the library maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 555 West 57th Street, 12th Floor, New York, New York 10019.

EUROPEAN: An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England for public access. The British Library Lending Division also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols # and * from ESA - Information Retrieval Service European Space Agency, 8-10 rue Mario-Nikis, 75738 Paris CEDEX 15, France.

FEDERAL DEPOSITORY LIBRARY PROGRAM

In order to provide the general public with greater access to U.S. Government publications, Congress established the Federal Depository Library Program under the Government Printing Office (GPO), with 50 regional depositories responsible for permanent retention of material, inter-library loan, and reference services. At least one copy of nearly every NASA and NASA-sponsored publication, either in printed or microfiche format, is received and retained by the 50 regional depositories. A list of the regional GPO libraries, arranged alphabetically by state, appears on the inside back cover. These libraries are *not* sales outlets. A local library can contact a Regional Depository to help locate specific reports, or direct contact may be made by an individual.

ADDRESSES OF ORGANIZATIONS

American Institute of Aeronautics and Astronautics
Technical Information Service
555 West 57th Street, 12th Floor
New York, New York 10019

British Library Lending Division,
Boston Spa, Wetherby, Yorkshire,
England

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, D.C. 20231

Department of Energy
Technical Information Center
P.O. Box 62
Oak Ridge, Tennessee 37830

ESA-Information Retrieval Service
ESRIN
Via Galileo Galilei
00044 Frascati (Rome) Italy

ESDU International, Ltd.
1495 Chain Bridge Road
McLean, Virginia 22101

ESDU International, Ltd.
251-259 Regent Street
London, W1R 7AD, England

Fachinformationszentrum Energie, Physik, Mathematik GMBH
7514 Eggenstein Leopoldshafen
Federal Republic of Germany

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Scientific and Technical Information Facility
P.O. Box 8757
B.W.I. Airport, Maryland 21240

National Aeronautics and Space Administration
Scientific and Technical Information Branch (NTT-1)
Washington, D.C. 20546

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, California 94063

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, Michigan 48106

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Geological Survey Library
National Center – MS 950
12201 Sunrise Valley Drive
Reston, Virginia 22092

U.S. Geological Survey Library
2255 North Gemini Drive
Flagstaff, Arizona 86001

U.S. Geological Survey
345 Middlefield Road
Menlo Park, California 94025

U.S. Geological Survey Library
Box 25046
Denver Federal Center, MS 914
Denver, Colorado 80225

NTIS PRICE SCHEDULES

(Effective October 1, 1985)

Schedule A
STANDARD PRICE DOCUMENTS AND MICROFICHE

PRICE CODE	PAGE RANGE	NORTH AMERICAN PRICE	FOREIGN PRICE
A01	Microfiche	$ 5.95	$11.90
A02-A03	001-050	9.95	19.90
A04-A05	051-100	11.95	23.90
A06-A09	101-200	16.95	33.90
A10-A13	201-300	22.95	45.90
A14-A17	301-400	28.95	57.90
A18-A21	401-500	34.95	69.90
A22-A25	501-600	40.95	81.90
A99	601-up	*	*
NO1		$40.00	70.00
NO2		40.00	70.00

Schedule E
EXCEPTION PRICE DOCUMENTS AND MICROFICHE

PRICE CODE	NORTH AMERICAN PRICE	FOREIGN PRICE
E01	$ 7.50	15.00
E02	10.00	20.00
E03	11.00	22.00
E04	13.50	27.00
E05	15.50	31.00
E06	18.00	36.00
E07	20.50	41.00
E08	23.00	46.00
E09	25.50	51.00
E10	28.00	56.00
E11	30.50	61.00
E12	33.00	66.00
E13	35.50	71.00
E14	38.50	77.00
E15	42.00	84.00
E16	46.00	92.00
E17	50.00	100.00
E18	54.00	108.00
E19	60.00	120.00
E20	70.00	140.00
E99	*	*

*Contact NTIS for price quote.

IMPORTANT NOTICE

NTIS Shipping and Handling Charges (effective June 1, 1985)

U.S., Canada, Mexico — ADD $3.00 per TOTAL ORDER

All Other Countries — ADD $4.00 per TOTAL ORDER

Exceptions — Does NOT apply to:

ORDERS REQUESTING NTIS RUSH HANDLING
ORDERS FOR SUBSCRIPTION OR STANDING ORDER PRODUCTS *ONLY*

NOTE: Each additional delivery address on an order requires a separate shipping and handling charge.

VOLUME 24 NUMBER 18 / SEPTEMBER 23, 1986

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics.*

01 AERONAUTICS (GENERAL) 2833

02 AERODYNAMICS 2833

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*

03 AIR TRANSPORTATION AND SAFETY 2847

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 2847

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications.*

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 2849

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

06 AIRCRAFT INSTRUMENTATION 2849

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

07 AIRCRAFT PROPULSION AND POWER 2850

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

08 AIRCRAFT STABILITY AND CONTROL 2851

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 2851

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*

12 ASTRONAUTICS (GENERAL) 2853

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

13 ASTRODYNAMICS 2860

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

15 LAUNCH VEHICLES AND SPACE VEHICLES 2860

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 2860

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

17 SPACECRAFT COMMUNICATION, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 2861

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

19 SPACECRAFT INSTRUMENTATION N.A.

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

20 SPACECRAFT PROPULSION AND POWER 2870

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 2872
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 2872
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 2873
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics.*

26 METALLIC MATERIALS 2875
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 2876
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 2878
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics.*

31 ENGINEERING (GENERAL) 2879
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 2886
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING 2897
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

34 FLUID MECHANICS AND HEAT TRANSFER 2900
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 INSTRUMENTATION AND PHOTOGRAPHY 2904
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation.*

36 LASERS AND MASERS 2906
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 2907
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 2913
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 2915
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) 2918

43 EARTH RESOURCES 2919
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION 2920
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

45 ENVIRONMENT POLLUTION 2922
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 2923
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation.*

47 METEOROLOGY AND CLIMATOLOGY 2947
Includes weather forecasting and modification.

48 OCEANOGRAPHY 2949
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 2949
Includes genetics.

52 AEROSPACE MEDICINE 2956
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 2960
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT N.A.
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY 2961
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 2961
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

61 COMPUTER PROGRAMMING AND SOFTWARE 2961
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 2964
Includes computer networks.

63 CYBERNETICS 2965
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS 2965
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 2967
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS N.A.
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 2968
Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering.*

70 PHYSICS (GENERAL) 2968
For geophysics see *46 Geophysics.* For astrophysics see *90 Astrophysics.* For solar physics see *92 Solar Physics.*

71 ACOUSTICS 2968
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

72 ATOMIC AND MOLECULAR PHYSICS 2969
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 2970
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

74 OPTICS 2970
Includes light phenomena.

75 PLASMA PHYSICS 2971
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 2973
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 2974
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) 2974
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2975
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2976
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 2976
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2977
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2977
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 2977

89 ASTRONOMY 2980
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2981
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2981
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2982
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2984
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

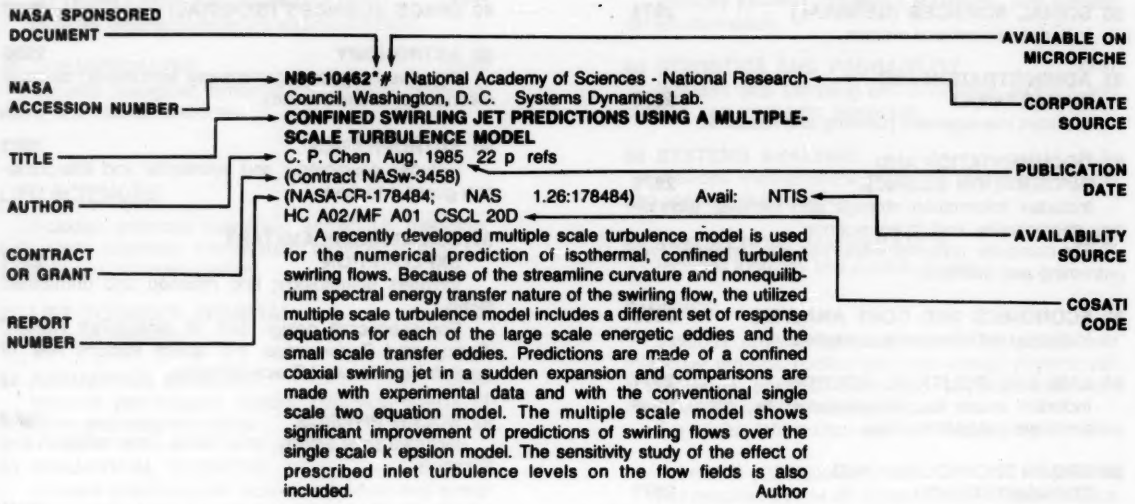
GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-59
CORPORATE SOURCE INDEX I-67
CONTRACT NUMBER INDEX I-79
REPORT/ACCESSION NUMBER INDEX I-81

TYPICAL CITATION AND ABSTRACT


NASA SPONSORED DOCUMENT
AVAILABLE ON MICROFICHE
NASA ACCESSION NUMBER
N86-10462*# National Academy of Sciences - National Research Council, Washington, D. C. Systems Dynamics Lab.
CORPORATE SOURCE
TITLE
CONFINED SWIRLING JET PREDICTIONS USING A MULTIPLE-SCALE TURBULENCE MODEL
AUTHOR
C. P. Chen Aug. 1985 22 p refs
PUBLICATION DATE
CONTRACT OR GRANT
(Contract NASw-3458)
REPORT NUMBER
(NASA-CR-178484; NAS 1.26:178484) Avail: NTIS
AVAILABILITY SOURCE
HC A02/MF A01 CSCL 20D
COSATI CODE
A recently developed multiple scale turbulence model is used for the numerical prediction of isothermal, confined turbulent swirling flows. Because of the streamline curvature and nonequilibrium spectral energy transfer nature of the swirling flow, the utilized multiple scale turbulence model includes a different set of response equations for each of the large scale energetic eddies and the small scale transfer eddies. Predictions are made of a confined coaxial swirling jet in a sudden expansion and comparisons are made with experimental data and with the conventional single scale two equation model. The multiple scale model shows significant improvement of predictions of swirling flows over the single scale k epsilon model. The sensitivity study of the effect of prescribed inlet turbulence levels on the flow fields is also included.
Author

VOLUME 24 NUMBER 18 / SEPTEMBER 23, 1986

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N86-27178# Minority Services, Inc., Washington, D.C.
MICROWAVE LANDING SYSTEM (MLS) STATION INTERFACE CONTROL REPORT
Jun. 1986 182 p
(Contract DTFA01-86-Y-01010)
(DOT/FAA/PM-86/17) Avail: NTIS HC A09/MF A01

This report contains requirements which are applicable to the MLS Interfaces for the system control functions, Remote Monitoring and Maintenance System status and maintenance reporting functions, and the synchronization function. The purpose is to provide for complete interoperability of MLS ground equipments which may have a different design and/or manufacturer, serving opposite ends of the same runway. Information is provided for the communication protocol and message/data formats between the Maintenance Processor Subsystem (MPS) and the Remote Monitoring System (RMS) of an MLS. The Remote Control and Status Unit (RCSU) is the RMS focal point for the MLS. Similar information is provided for the interface/communications between the RCSU and the stations of the MLS. A Printer/Terminal (P/T) provides active interface with the MLS stations. Information on the P/T interface and the set of P/T commands is provided. The various operating/non operating states of the MLS are given. A set of data parameters is given which may be transmitted to the MPS as descriptors of the MLS operating status history, site related parameters, monitor related parameters and maintenance related parameters. Parameter information is provided for the intra-system synchronization function. Author

N86-27179# Grand Canyon National Park, Ariz. Resources Management and Planning Div.
AIRCRAFT INFORMATION PACKET (GRAND CANYON NATIONAL PARK, ARIZONA)
Sep. 1985 53 p
(PB86-159704; GCNP/AIR/INFO-85/1) Avail: NTIS HC A04/MF A01 CSCL 01B

The Aircraft Information Packet presents an overview of the aircraft overflight issue at Grand Canyon National Park which was made available for public review in September 1985. The packet consists of a task directive and pre-planning booklet distributed for public review and comment from September 17, 1985 through December 17, 1985. The task directive provides a background of the aircraft issue at Grand Canyon, the legal and policy constraints under which the management plan is being developed, a summary of research to date, and a discussion of the planning process being followed. The pre-planning booklet provides an overview of current aircraft use, a summary of public involvement to date, and an analysis of possible mitigation actions being considered to address this issue. GRA

N86-27481# Joint Publications Research Service, Arlington, Va.
NEW FIGHTER-BOMBER IN AIR FORCE
In its East Europe report (JPRS-EER-86-031) 4 Mar. 1986 p 103-104 Transl. into ENGLISH from Soldat und Technik (Frankfurt/Main, West Germany), no. 12, Dec. 1985 p 786 (For primary document see N86-27479 18-31)
Avail: NTIS HC A08/MF A01

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N86-27180 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, s'Gravenhage (Netherlands). Hoofdgroep Maatschappelijke Technologie.
THE WAKE OF A HORIZONTAL-AXIS WIND TURBINE MODEL; MEASUREMENTS IN UNIFORM APPROACH FLOW AND IN A SIMULATED ATMOSPHERIC BOUNDARY LAYER
A. M. Talmon Aug. 1985 65 p Revised report of RUU-CS-85-3 Original contains color illustrations
(Rept-85-010121; MT-TNO-8724-12433; ESA-86-97014) Copyright. Avail: Issuing Activity

Wind tunnel measurements of the wake of a wind turbine model were conducted to refine calculations of wake effects in wind turbine parks. Wake effects caused by tower and nacelle were studied in uniform flow. Wake development depending on tip speed ratio was studied in a simulated atmospheric boundary layer. Wind tunnel results show that ground effects inhibit vertical growth of the lower part of the wake. Turbine drag and centerline velocity defects are strongly interrelated. The velocity defect wake profile of a wind turbine shifts slightly towards the ground. ESA

N86-27181# Old Dominion Univ., Norfolk, Va. Dept. of Engineering.
AN EVALUATION OF A TAYLOR-GALERKIN ALGORITHM FOR HIGH SPEED INVISCID FLOWS USING QUADRILATERAL AND TRIANGULAR ELEMENTS M.S. Thesis
Kim S. Bey Mar. 1986 156 p
Avail: NTIS HC A08/MF A01 CSCL 01A

The Taylor-Galerkin finite element algorithm is used to obtain solutions to the two-dimensional compressible Euler equations. The mathematical formulation of the algorithm is presented for a typical scalar equation. The derivation results in element equations which are assembled over the entire solution domain to obtain the system of equations that are solved explicitly. The algorithm has the feature that the finite element matrices can be evaluated in closed form, avoiding expensive numerical integration. Aspects of vector programming strategies and mesh generation important to an effective analysis procedure are also described. Solutions to supersonic flow problems with exact solutions are computed and compared for meshes containing all quadrilateral and triangular elements. Solutions to hypersonic flow over a blunt body are

computed for different meshes and compared with solutions from other numerical techniques. Solution to the flow in the cove formed by the juncture of the Shuttle orbiter wing and elevon is computed and compared with experimental data. Author

N86-27182*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
UNSTEADY AERODYNAMICS-FUNDAMENTALS AND APPLICATIONS TO AIRCRAFT DYNAMICS
D. G. Mabey (Royal Aircraft Establishment, Bedford, England) and J. R. Chambers 1985 18 p
(NASA-TM-88768; NAS 1.15:88768; AGARD-AR-222; ISBN-92-835-1515-3) Avail: NTIS HC A02/MF A01 CSCL 01A

From May 6 to 9, 1985, the Fluid Dynamics Panel and Flight Mechanics Panel of AGARD jointly arranged a Symposium on Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics at the Stadthall, Gottingen, West Germany. This Symposium was organized by an international program committee chaired by Dr K. J. Orlik-Ruckemann of the Fluid Dynamics Panel. The program consisted of five sessions grouped in two parts: (1) Fundamentals of Unsteady Aerodynamics; and (2) Applications to Aircraft Dynamics. The 35 papers presented at the 4 day meeting are published in AGARD CP 386 and listed in the Appendix. As the papers are already available and cover a very wide field, the evaluators have offered brief comments on every paper, followed by an overall evaluation of the meeting, together with some general conclusions and recommendations. Author

N86-27183# National Aerospace Lab., Tokyo (Japan).
AN EXPERIMENT ON SUPERSONIC TURBULENT MIXING LAYERS
Tomoyuki Komuro, Atsuo Murakami, Kenji Kudou, Nobuo Chinzei, and Goro Masuya Oct. 1985 16 p In JAPANESE; ENGLISH summary
(NAL-TR-884; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

An experimental study on single stream and two stream supersonic mixing layers was made to investigate the effect of compressibility on their mean properties. Free streams on both sides of the two stream mixing layer had Mach numbers of 2.3 and 1.35 with a velocity ratio of 0.74. One or the other of the streams was blocked for the single stream experiment. Pitot and static pressure surveys were conducted to deduce mean velocity profiles. Self-similar and linearly spreading flows were established at distances of approximately 100 and 200 times the momentum thickness of separated boundary layer from the beginning point of the mixing layer for the single and two stream cases, respectively. It was found that weak compression and expansion waves remaining in a test section have little effect on the spreading. In the single stream case, spreading rates decreased with increasing free stream Mach number. This tendency agrees not only qualitatively but also quantitatively with the tendency obtained in the majority of the previous experiments. The spreading rate of the two stream mixing layer was about half of that in the single stream layer with the same free stream Mach number as the high velocity side. This result agreed with previously obtained spreading rates for incompressible two stream mixing layers with the same value of velocity ratio. In the present two stream mixing layer, therefore, it can be concluded that there was no compressibility effect because of the small velocity difference. Author

N86-27184# National Aerospace Lab., Tokyo (Japan). Second Aerodynamics Div.
COMPUTATION OF 3-DIMENSIONAL VISCOUS TRANSONIC FLOWS USING THE LU-ADI FACTORED SCHEME
Kozo Fujii and Shigeru Obayashi Nov. 1985 20 p
(NAL-TR-889T; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

The LU-ADI (lower/upper block diagonal - alternating direction implicit) factored scheme was successfully applied to solve the three-dimensional compressible thin layer Navier-Stokes equations. The computations are carried out for the slightly supersonic flow over a hemispheric cylinder at high incidence and for the transonic flow over a swept wing. To simulate these complicated flow fields, fine grid distributions of up to about 200,000 points were used on the Japanese supercomputer of 1 GFLOPS. The total cpu time for each case was less than two hours. The results for the flow over a hemispheric cylinder at high incidence revealed the existence of the shock wave and the detailed structure of the vortical flow field on the leeward side. The result for the flow over the swept wing shows that the three-dimensional shock induced separation is well captured. These results indicate the capability of the present code to make three-dimensional complicated flow field simulations; and the application of the present code to the more practical flow fields such as transonic flows over the wing or the wing-body combination of the transportation aircraft is very promising. Even simulation over the whole aircraft may soon be possible. Author

N86-27185# National Aerospace Lab., Tokyo (Japan).
WIND TUNNEL TEST AND ANALYSIS ON GUST LOAD ALLEVIATION OF A HIGH-ASPECT-RATIO WING
Nov. 1985 60 p In JAPANESE; ENGLISH summary
(NAL-TR-890; ISSN-0389-4010) Avail: NTIS HC A04/MF A01

Application of the active control technology to gust load alleviation problems was investigated both experimentally and analytically. Wind tunnel test were conducted for a high aspect ratio wing that assumes an energy efficient type of future transport. For these tests, National Aerospace Laboratory's low speed wind tunnel was equipped with a gust generator with hydraulic servo system. This generator generates turbulence by utilizing the tip vortices from the cantilevered double wings. Atmospheric turbulence was simulated in the tunnel according to the Dryden mathematical model. Control surfaces of the flexible wing model were actuated by a small dc electric motor embedded in the airfoil. A handy analog computer played the role of controller to drive control surfaces by the signals from two accelerometers and a strain gauge which was installed in the model as feedback sensors. Control laws were obtained by the optimal control theory with its performance index selected as the total energy of the system. Simple control laws based on the LQG theory demonstrated their effectiveness against realistic random gusts. At the end of the test, the flutter boundary of this model was determined for the configuration without active control. Author

N86-27186*# Kansas Univ., Lawrence. Dept. of Aerospace Engineering.
EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF A FREEZING POINT DEPRESSANT FLUID ICE PROTECTION SYSTEM M.S. Thesis. Final Report
Alan E. Albright Sep. 1984 149 p
(Grant NAG3-273)
(NASA-CR-174758; NAS 1.26:174758) Avail: NTIS HC A07/MF A01 CSCL 01A

A glycol-exuding porous leading edge ice protection system was tested in the NASA Icing Research Tunnel. Stainless steel mesh, laser drilled titanium, and composite panels were tested on two general aviation wing sections. Two different glycol-water solutions were evaluated. Minimum glycol flow rates required for anti-icing were obtained as a function of angle of attack, liquid water content, volume median drop diameter, temperature, and velocity. Ice accretions formed after five minutes of icing were shed in three minutes or less using a glycol fluid flow equal to the anti-ice flow rate. Two methods of predicting anti-ice flow rates are presented and compared with a large experimental data base of anti-ice flow rates over a wide range of icing conditions. The first method presented in the ADS-4 document typically predicts flow rates lower than the experimental flow rates. The second method, originally published in 1983, typically predicts flow rates up to 25 percent higher than the experimental flow rates. This method proved to be more consistent between wing-panel configurations. Significant correlation coefficients between the predicted flow rates and the experimental flow rates ranged from .867 to .947. Author

N86-27187# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Fluid Dynamics Panel.
AIRCRAFT DRAG PREDICTION AND REDUCTION. ADDENDUM

1: COMPUTATIONAL DRAG ANALYSES AND MINIMIZATION; MISSION IMPOSSIBLE?
J. W. Slooff (National Aerospace Lab., Amsterdam, Netherlands) Apr. 1986 33 p Presented at Aircraft Drag Prediction and Reduction, Rhode Saint Genese, Belgium, 20-23 May 1985, and Hampton, Va., 5-8 Aug. 1985; sponsored by the von Karman Inst., AGARD, and NASA Langley Research Center
(AGARD-R-723-Add-1; ISBN-92-835-1524-2) Avail: NTIS HC A03/MF A01

The Special Course on Aircraft Drag Prediction was sponsored by the AGARD Fluid Dynamics Panel and the von Karman Institute and presented at the von Karman Institute, Rhode-Saint-Genese, Belgium, on 20 to 23 May 1985 and at the NASA Langley Research Center, Hampton, Virginia, USA, 5 to 6 August 1985. The course began with a general review of drag reduction technology. Then the possibility of reduction of skin friction through control of laminar flow and through modification of the structure of the turbulence in the boundary layer were discussed. Methods for predicting and reducing the drag of external stores, of nacelles, of fuselage protuberances, and of fuselage afterbodies were then presented followed by discussion of transonic drag rise. The prediction of viscous and wave drag by a method matching inviscid flow calculations and boundary layer integral calculations, and the reduction of transonic drag through boundary layer control are also discussed. This volume comprises Paper No.9 Computational Drag Analyses and Minimization: Mission Impossible? which was not included in AGARD Report 723 (main volume). Author

N86-27188*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Engineering Mechanics.
SIMULATION OF SELF-INDUCED UNSTEADY MOTION IN THE NEAR WAKE OF A JOUKOWSKI AIRFOIL Semiannual Progress Report
K. N. Ghia, G. A. Osswald, and U. Ghia 1986 14 p refs
(Grants NAG1-465; AF-AFOSR-0231-85)
(NASA-CR-177273; NAS 1.26:177273) Avail: NTIS HC A02/MF A01 CSCL 01A

The unsteady Navier-Stokes analysis is shown to be capable of analyzing the massively separated, persistently unsteady flow in the post-stall regime of a Joukowski airfoil for an angle of attack as high as 53 degrees. The analysis has provided the detailed flow structure, showing the complex vortex interaction for this configuration. The aerodynamic coefficients for lift, drag, and moment were calculated. So far only the spatial structure of the vortex interaction was computed. It is now important to potentially use the large-scale vortex interactions, an additional energy source, to improve the aerodynamic performance. B.G.

N86-27189*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TURBULENT FLOW FIELD PREDICTIONS IN SHARPLY CURVED TURN-AROUND DUCTS Final Report
L. Michael Santi Washington NASA Jun. 1986 34 p Previously announced as N86-24542
(Grant NGT-01-008-021)
(NASA-CR-3990; NAS 1.26:3990; M-529) Avail: NTIS HC A03/MF A01 CSCL 01A

Two-dimensional turbulent flow of incompressible Newtonian fluids in sharply curved 180 deg turn around ducts is studied. Results of an approximate numerical flow field analysis utilizing an orthogonal, body-fitted, curvilinear coordinate system are compared to results based on a traditional cylindrical reference frame. Qualitative induction of general streamfield characteristics as well as quantitative benchmarks for the planning of future experimentation are provided. In addition, preliminary results of an augmented kappa - epsilon turbulence model analysis, which explicitly accounts for the effects of streamline curvature and pressure strain in internal turbulent flows, are presented. Specific model difficulties are discussed and comparisons with standard kappa - epsilon model predictions are included. Author

N86-27190*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VORTEX FLOW AERODYNAMICS, VOLUME 1
James F. Campbell, ed., Russell F. Osborn, ed. (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio), and Jerome T. Foughner, Jr., ed. Jul. 1986 404 p Conference held in Hampton, Va., 8-10 Oct. 1985
(NASA-CP-2416-Vol-1; L-16117; NAS 1.55:2416-Vol-1) Avail: NTIS HC A18/MF A01 CSCL 01A

Vortex modeling techniques and experimental studies of research configurations utilizing vortex flows are discussed. Also discussed are vortex flap investigations using generic and airplane research models and vortex flap theoretical analysis and design studies. For individual titles, see N86-27191 through N86-27208.

N86-27191*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VORTEX LIFT RESEARCH: EARLY CONTRIBUTIONS AND SOME CURRENT CHALLENGES
Edward C. Polhamus *In its* Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 1-30 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

The trend towards slender wing aircraft for supersonic cruise and the early chronology of research directed towards their vortex-lift characteristics are briefly reviewed. An overview of the development of vortex-lift theoretical methods is presented, and some current computational and experimental challenges related to the viscous flow aspects of this vortex flow are discussed.
Author

N86-27192*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LEADING-EDGE VORTEX RESEARCH: SOME NONPLANAR CONCEPTS AND CURRENT CHALLENGES
James F. Campbell and Russell F. Osborn (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio) *In its* Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 31-63 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

Some background information is provided for the Vortex Flow Aerodynamics Conference and that current slender wing airplanes do not use variable leading edge geometry to improve transonic drag polar is shown. Highlights of some of the initial studies combining wing camber, or flaps, with vortex flow are presented. Current vortex flap studies were reviewed to show that there is a large subsonic data base and that transonic and supersonic generic studies have begun. There is a need for validated flow field solvers to calculate vortex/shock interactions at transonic and supersonic speeds. Many important research opportunities exist for fundamental vortex flow investigations and for designing advanced fighter concepts. Author

N86-27193*# Kansas Univ., Lawrence. Dept. of Aerospace Engineering.
EXTENSIONS OF THE CONCEPT OF SUCTION ANALOGY TO PREDICTION OF VORTEX LIFT EFFECT
C. Edward Lan *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 65-84 (For primary document see N86-27190 18-02)
(Grant NsG-1629)
Avail: NTIS HC A18/MF A01 CSCL 01A

Flow field data for a double delta wing at low speed were used to determine the location of a vortex action point. The result was found to be consistent with what was determined for a delta wing. In supersonic flow, the action point location was determined empirically. For a wing with rounded leading edges, an assumption for initial vortex separation was shown to be equivalent to initial leading edge bubble separation for airfoils. A theoretical formulation by the section analogy to determine the delayed vortex separation on a cambered wing with rounded leading edges was presented. The method of suction analogy was further shown to be applicable to predicting the body vortex lift. Author

N86-27194*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RECENT EXTENSIONS TO THE FREE-VORTEX-SHEET THEORY FOR EXPANDED CONVERGENCE CAPABILITY
James M. Luckring, Keith D. Hoffler (Vigyan Research Associates, Inc., Hampton, Va.), and Arthur C. Grantz (Northrop Corp., Hawthorne, Calif.) *In its* Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 85-114 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

A new version of the free vortex sheet formulation is presented which has greatly improved convergence characteristics for a broad range of geometries. The enhanced convergence properties were achieved largely with extended modeling capabilities of the leading edge vortex and the near field trailing wake. Results from the new code, designated FVS-1, are presented for a variety of configurations and flow conditions with emphasis on vortex flap applications. Author

N86-27195*# North Carolina State Univ., Raleigh.
A DIRECT AND INVERSE BOUNDARY LAYER METHOD FOR SUBSONIC FLOW OVER DELTA WINGS
Shawn H. Woodson and Fred R. DeJarnette *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 115-133 (For primary document see N86-27190 18-02)
(Contract NCC1-22)
Avail: NTIS HC A18/MF A01 CSCL 01A

A new inverse boundary layer method is developed and applied to incompressible flows with laminar separation and reattachment. Test cases for two dimensional flows are computed and the results are compared with those of other inverse methods. One advantage of the present method is that the calculation of the inviscid velocities may be determined at each marching step without having to iterate. The inverse method was incorporated with the direct method to calculate the incompressible, conical flow over a slender delta wing at incidence. The location of the secondary separation line on the leeward surface of the wing is determined and compared with experiment for a unit aspect ratio wing at 20.5 deg incidence. The viscous flow in the separated region was calculated using prescribed skin friction coefficients. Author

N86-27196*# Notre Dame Univ., Ind.
AN EXPERIMENTAL INVESTIGATION OF VORTEX BREAKDOWN ON A DELTA WING
F. M. Payne and R. C. Nelson *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 135-161 (For primary document see N86-27190 18-02)
(Grant NAG2-258)
Avail: NTIS HC A18/MF A01 CSCL 01A

An experimental investigation of vortex breakdown on delta wings at high angles is presented. Thin delta wings having sweep angles of 70, 75, 80 and 85 degrees are being studied. Smoke flow visualization and the laser light sheet technique are being used to obtain cross-sectional views of the leading edge vortices as they break down. At low tunnel speeds (as low as 3 m/s) details of the flow, which are usually imperceptible or blurred at higher speeds, can be clearly seen. A combination of lateral and longitudinal cross-sectional views provides information on the three dimensional nature of the vortex structure before, during and after breakdown. Whereas details of the flow are identified in still photographs, the dynamic characteristics of the breakdown process were recorded using high speed movies. Velocity measurements were obtained using a laser Doppler anemometer with the 70 degree delta wing at 30 degrees angle of attack. The measurements show that when breakdown occurs the core flow transforms from a jet-like flow to a wake-like flow. Author

N86-27197*# Lockheed-Georgia Co., Marietta.
LASER VELOCIMETRY IN HIGHLY THREE-DIMENSIONAL AND VORTICAL FLOWS
Charles J. Novak, Charles R. Huie, and Kenneth C. Cornelius *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 163-185 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

The need for experimentally determined 3-D velocity information is crucial to the understanding of highly 3-dimensional and vortical flow fields. In addition to gaining an understanding of the physics of flow fields, a correlation of velocity data is needed for advanced computational modelling. A double pass method for acquiring 3-D flow field information using a 2-D laser velocimeter (LV) is described. The design and implementation of a 3-D LV with expanded capabilities to acquire real-time 3-D flow field information are also described. Finally, the use of such an instrument in a wind tunnel study of a generic fighter configuration is described. The results of the wind tunnel study highlight the complexities of 3-D flow fields, particularly when the vortex behavior is examined over a range of angles of attack. Author

N86-27198*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IN-FLIGHT AND WIND TUNNEL LEADING-EDGE VORTEX STUDY ON THE F-106B AIRPLANE
John E. Lamar *In its* Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 187-201 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

The vapor screen technique was successfully applied to an F-106B fighter aircraft during subsonic and transonic maneuvers. This system has allowed the viewing of multiple vortex systems on the wing upper surface at angles of attack less than 19 deg. In addition, similarities as well as differences were determined to exist between the vortex systems for a full scale semispan model and the flight vehicle at 20 deg incidence. Furthermore, variations in Reynolds number and Mach number were identified as to how they affect vortex system details at flight conditions. Author

N86-27199*# Vigyan Research Associates, Inc., Hampton, Va.
BASIC STUDIES ON DELTA WING FLOW MODIFICATIONS BY MEANS OF APEX FENCES
Keith D. Hoffler, Dhanvada M. Rao, and Mark C. Frassinelli (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio) *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 203-217 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

The effectiveness of apex fences on a 60-deg delta wing at low speeds was experimentally investigated. Resembling highly swept spoilers in appearance, the fences are designed to fold out of the wing apex region upper surface near the leading edges, where they generate a powerful vortex pair. The intense suction of the fence vortices augments lift in the apex region, the resulting positive pitching moment being utilized to trim trailing edge flaps for lift augmentation during approach and landing at relatively low angles of attack. The fences reduce the apex lift at high angles of attack, leading to a desirable nose-down moment. The above projected functions of the apex fence device were validated and quantified through low speed tunnel tests, comprising upper surface pressure surveys on a semispan model and balance measurements on a geometrically similar fully span wing/body configuration. Fence parameters such as area, shape, hinge position and deflection angle were investigated. Typical results are presented indicating the apex fence potential in controlling the longitudinal characteristics of a tail-less delta. Author

N86-27200*# Vigyan Research Associates, Inc., Hampton, Va.
TOWARDS AN ADVANCED VORTEX FLAP SYSTEM: THE CAVITY FLAP
Dhanvada M. Rao *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 219-230 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

An extension of the vortex flap concept was explored with the aim of providing high-alpha flight control capability coupled with maneuver drag reduction for highly swept wing configurations. A retractable lower surface flap mounted on a translating hinge is proposed, allowing chordwise extension as well as deflection, the

two movements being independently controlled. The frontal cavity formed by the partially extended and deflected flap captures a vortex above a certain angle of attack. The cavity vortex downwash alleviates the effective incidence of the wing leading edge, thus modulating vortex lift; at the same time, the induced suction in the cavity generates thrust. These postulated aerodynamic features of the cavity flap were validated through low speed tunnel pressure and visualization tests on a 65 deg swept oblique wing model, which also provided initial trends of the leading edge vortex alleviation and cavity suction with respect to flap extension, deflection and angle of attack. Force tests on a 60 deg delta model further showed the cavity flap L/D performance to compare favorably with the conventional vortex flap. A two segment flap arrangement with independently control led segments was envisaged for exploiting the vortex modulation capability of the cavity flap for pitch, roll and yaw control, in addition to drag reduction at high angles of attack. Author

N86-27201*# General Dynamics Corp., Fort Worth, Tex.
VORTEX FLOW HYSTERESIS
Atlee M. Cunningham, Jr. *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 231-248 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

An experimental study was conducted to quantify the hysteresis associated with various vortex flow transition points and to determine the effect of planform geometry. The transition points observed consisted of the appearance (or disappearance) of trailing edge vortex burst and the transition to (or from) flat plate or totally separated flows. Flow visualization with smoke injected into the vortices was used to identify the transitions on a series of semi-span models tested in a low speed tunnel. The planforms tested included simple deltas (55 deg to 80 deg sweep), cranked wings with varying tip panel sweep and dihedral, and a straked wing. High speed movies at 1000 frames per second were made of the vortex flow visualization in order to better understand the dynamics of vortex flow, burst and transition. Author

N86-27202*# Boeing Military Airplane Development, Seattle, Wash.
VISCOUS VORTICAL FLOW CALCULATIONS OVER DELTA WINGS
G. Blom, J. C. Wai, and H. Yoshihara *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 249-261 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

Two approaches to calculate turbulent vortical flows over delta wing configurations are illustrated. The first is for a simple delta wing at low speeds using the boundary layer approximation to treat the effects of the secondary separation. The second is for the supersonic case of a generic fighter using the NASA Ames parabolized Navier/Stokes method. Test/theory comparisons are given in both cases. Author

N86-27203*# Lockheed-California Co., Burbank.
AN EULER AERODYNAMIC METHOD FOR LEADING-EDGE VORTEX FLOW SIMULATION
Pradeep Raj and Lyle N. Long (Lockheed-Advanced Aeronautics Co., Valencia, Calif.) *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 263-281 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

The current capabilities and the future plans for a three dimensional Euler Aerodynamic Method are described. The basic solution algorithm is based on the finite volume, Runge-Kutta pseudo-time-stepping scheme of FLO-57. Several modifications to improve accuracy and computational efficiency were incorporated and others are being investigated. The computer code is used to analyze a cropped delta wing at 0.6 Mach number and an arrow wing at 0.85 Mach number. Computed aerodynamic parameters are compared with experimental data. In all cases, the configuration is impulsively started and no Kutta condition is applied at sharp edges. The results indicate that with additional development and validation, the present method will be a useful tool for engineering analysis of high speed aircraft. Author

N86-27204*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
EULER ANALYSIS OF AN ELLIPTIC MISSILE BODY
James R. Sirbaugh *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 283-301 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

The Euler code FL057 was applied to a blunt nose smooth surface missile body shape. A range of angle of attacks was analyzed at Mach numbers of 0.55 and 2.0. A Mach number sweep from 0.55 to 2.0 was run for 12 degrees angle of attack. Experimental force and moment data were compared at Mach 2.0. The Euler code agreed with the experimental data over the linear portion of the Mach 0.55 data and over the entire angle-of-attack range at Mach 2.0. Author

N86-27205*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTATION OF LEADING-EDGE VORTEX FLOWS
Richard W. Newsome (Air Force Wright Aeronautical Labs., Hampton, Va.) and James L. Thomas *In its* Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 305-330 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

The simulation of the leading edge vortex flow about a series of conical delta wings through solution of the Navier-Stokes and Euler equations is studied. The occurrence, the validity, and the usefulness of separated flow solutions to the Euler equations of particular interest. Central and upwind difference solutions to the governing equations are compared for a series of cross sectional shapes, including both rounded and sharp tip geometries. For the rounded leading edge and the flight condition considered, viscous solutions obtained with either central or upwind difference methods predict the classic structure of vortical flow over a highly swept delta wing. Predicted features include the primary vortex due to leading edge separation and the secondary vortex due to crossflow separation. Central difference solutions to the Euler equations show a marked sensitivity to grid refinement. On a coarse grid, the flow separates due to numerical error and a primary vortex which resembles that of the viscous solution is predicted. In contrast, the upwind difference solutions to the Euler equations predict attached flow even for first-order solutions on coarse grids. On a sufficiently fine grid, both methods agree closely and correctly predict a shock-curvature-induced inviscid separation near the leeward plane of symmetry. Upwind difference solutions to the Navier-Stokes and Euler equations are presented for two sharp leading edge geometries. The viscous solutions are quite similar to the rounded leading edge results with vortices of similar shape and size. The upwind Euler solutions predict attached flow with no separation for both geometries. However, with sufficient grid refinement near the tip or through the use of more accurate spatial differencing, leading edge separation results. Once the leading edge separation is established, the upwind solution agrees with recently published central difference solutions to the Euler equations. Author

N86-27206*# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
STEADY SUPERSONIC NAVIER-STOKES SOLUTIONS OF A 75 DEG DELTA WING
Thomas A. Buter and Donald P. Rizzetta *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 331-347 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

Steady solutions about a slender sharp edged delta wing in a supersonic freestream for moderate and high angles of attack are obtained numerically by time integration of the unsteady compressible three dimensional laminar Navier-Stokes equations. The main features of the flow, including primary and secondary separation, and vortex position and strength, are adequately

simulated in the numerical solutions. Improved resolution of the computational grid in the leading edge region from a previous solution had considerable effect on the accuracy of the solutions. Good agreement between numerical solutions and experimental data was obtained for two cases. A local timestepping procedure is used to speed convergence by approximately a factor of two.
Author

N86-27207*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN OVERVIEW OF THE FUNDAMENTAL AERODYNAMICS BRANCH'S RESEARCH ACTIVITIES IN WING LEADING-EDGE VORTEX FLOWS AT SUPERSONIC SPEEDS
David S. Miller, Richard M. Wood, and Peter F. Covell *In its* Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 349-377 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

For the past 3 years, a research program pertaining to the study of wing leading edge vortices at supersonic speeds has been conducted in the Fundamental Aerodynamics Branch of the High-Speed Aerodynamics Division at the Langley Research Center. The purpose of the research is to provide an understanding of the factors governing the formation and the control of wing leading-edge vortices and to evaluate the use of these vortices for improving supersonic aerodynamic performance. The studies include both experimental and theoretical investigations and focus primarily on planform, thickness and camber effects for delta wings. An overview of this research activity is presented. Author

N86-27208*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WATER TUNNEL RESULTS OF LEADING-EDGE VORTEX FLAP TESTS ON A DELTA WING VEHICLE
John H. DelFrate *In* NASA. Langley Research Center Vortex Flow Aerodynamics, Vol. 1 Jul. 1986 p 379-389 (For primary document see N86-27190 18-02)
Avail: NTIS HC A18/MF A01 CSCL 01A

A water tunnel flow visualization test on leading edge vortex flaps was conducted at the flow visualization facility of the NASA Ames Research Center's Dryden Flight Research Facility. The purpose of the test was to visually examine the vortex structures caused by various leading edge vortex flaps on the delta wing of an F-106 model. The vortex flaps tested were designed analytically and empirically at the NASA Langley Research Center. The three flap designs were designated as full-span gothic flap, full-span untapered flap, and part-span flap. The test was conducted at a Reynolds number of 76,000/m (25,000/ft). This low Reynolds number was used because of the 0.076-m/s (0.25-ft/s) test section flow speed necessary for high quality flow visualization. However, this low Reynolds number may have influenced the results. Of the three vortex flaps tested, the part-span flap produced what appeared to be the strongest vortex structure over the flap area. The full-span gothic flap provided the next best performance.
Author

N86-27209*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF 3 NUMERICAL METHODS FOR PROPULSION INTEGRATION STUDIES ON TRANSONIC TRANSPORT CONFIGURATIONS
Steven F. Yaros, John R. Carlson, and Balasubramanyan Chandrasekaran (Vigyan Research Associates, Inc., Hampton, Va.) Jun. 1986 23 p Presented at the 4th AIAA Applied Aerodynamics Conference, San Diego, Calif., 9-11 Jun. 1986
(NASA-TM-87727; NAS 1.15:87727; AIAA-86-1814) Avail: NTIS HC A02/MF A01 CSCL 01A

An effort has been undertaken at the NASA Langley Research Center to assess the capabilities of available computational methods for use in propulsion integration design studies of transonic transport aircraft, particularly of pylon/nacelle combinations which exhibit essentially no interference drag. The three computer codes selected represent state-of-the-art computational methods for analyzing complex configurations at subsonic and transonic flight conditions. These are: EULER, a finitie volume solution of the Euler equation; VSAERO, a panel solution of the Laplace equation; and PPW, a finite difference solution of the small disturbance transonic equations. In general, all three codes have certain capabilities that allow them to be of some value in predicting the flows about transport configurations, but all have limitations. Until more accurate methods are available, careful application and interpretation of the results of these codes are needed.
Author

N86-27210# National Aeronautical Lab., Bangalore (India). Director's Unit.
THE LIFT ON AN AIRFOIL IN A TURBULENT BOUNDARY LAYER
S. Kishore Kumar and R. Barasimha Mar. 1986 42 p
(NAL-TM-DU-8601) Avail: NTIS HC A03/MF A01

Following a general formulation of the problem, detailed results are presented when the mean velocity in the turbulent boundary layer is given by the one-seventh power law. The lift on the airfoil is computed as the sum of contributions from shear and incidence, taking into account the presence of the wall. It is found that for an airfoil with a chord equal to the boundary layer thickness delta, the shear effect is generally dominant over all other factors. Furthermore, the lift coefficient, based on either the velocity at the position of the airfoil or that at the edge of the boundary layer, decreases monotonically as the height above the wall increases.
Author

N86-27211# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
AN INTERFEROMETRIC INVESTIGATION OF THE REGULAR TO MACH REFLECTION TRANSITION BOUNDARY IN PSEUDOSTATIONARY FLOW IN AIR
John Wheeler Apr. 1986 152 p Sponsored in cooperation with the Natural Sciences and Engineering Research Council of Canada
(Contract DNA-001-85-C-0368; Grant AF-AFOSR-82-0096)
(UTIAS-TN-256; ISSN-0082-5263) Avail: NTIS HC A08/MF A01

The regular (RR) to Mach reflection (MR) transition boundary in pseudostationary flow in air was investigated, with emphasis on the influence of shock-induced boundary layer. Nearly 100 experiments were conducted in the region of the RR/MR transition line over a range of incident-shock-wave Mach number 1.1 $<$ M sub s $>$ 6.5 by conducting experiments in the UTIAS 10 x 18 cm Hypervelocity Shock Tube. The wedge angles used were 42 deg, 45 deg, 47 deg, and 48 deg. Initial pressures were kept as low as possible to maximize viscous effects and ranged from 0.4 kPa to 100 kPa. A comparison was made between the boundary-layer thickness, and the deviation of the transition boundary from inviscid theory. This difference is often called the von Neumann paradox. It was found that the von Neumann paradox was due to viscous effects. The deviation of the RR/MR transition line from the detachment criterion boundary was found to increase with a drop in initial pressure, in a manner consistent with boundary-layer theory. The effect of the endwall boundary layer on the RR/MR transition line was more pronounced at low Mach number (M sub s s $<$ 2), and a model is proposed to explain this behavior. Initial pressure was also found to influence the height of the Mach stem in MR. Lower initial pressure (and hence greater viscous effects) reduced the height of the Mach stem, which was found to be smaller than the inviscid prediction in all MR experiments.
Author

N86-27212# National Aeronautical Lab., Bangalore (India). Aerodynamics Div.
ANALYSIS OF WINGS WITH LEADING EDGE AND/OR TRAILING EDGE SEGMENTED (SPANWISE) FLAPS USING PLANAR HORSE SHOE VORTEX LATTICE METHOD
B. Rajeswari and H. N. V. Dutt Nov. 1985 74 p
(NAL-TM-AE-8507) Avail: NTIS HC A04/MF A01

A method and a computer program in FORTRAN have been developed for the analysis of wings with segmented leading edge and trailing edge flaps using planar horse-shoe vortices. This

computer program can be used to estimate overall aerodynamic characteristics like C sub L, C sub D and C sub M and the detailed local loads for a given wing flap geometry at specified incidence and Mach number. The method has no limitations on aspect ratio, taper ratio and sweep angles. The code has been validated for a number of cases for which experimental data is available. The program is working on UNIVAC 1100-60 computer and takes about 2 minutes to analyze a typical wing-flap configuration (with approximately 120 panels) for a given incidence and Mach number. Author

N86-27213*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY RESULTS OF UNSTEADY BLADE SURFACE PRESSURE MEASUREMENTS FOR THE SR-3 PROPELLER

Laurence J. Heidelberg and Bruce J. Clark 1986 26 p Presented at the 10th Aeroacoustics Conference, Seattle, Wash., 9-11 Jul. 1986

(NASA-TM-87352; E-3106; NAS 1.15:87352; AIAA-86-1893) Avail: NTIS HC A03/MF A01 CSCL 01A

Unsteady blade surface pressures were measured on an advanced, highly swept propeller known as SR-3. These measurements were obtained because the unsteady aerodynamics of these highly loaded transonic blades is important to noise generation and aeroelastic response. Specifically, the response to periodic angle-of-attack change was measured for both two- and eight-bladed configurations over a range of flight Mach numbers from 0.4 to 0.85. The periodic angle-of-attack change was obtained by placing the propeller axis at angles up to 4 deg to the flow. Most of the results are presented in terms of the unsteady pressure coefficient variation with Mach number. Both cascade and Mach number effects were largest on the suction surface near the leading edge. The results of a three-dimensional Euler code applied in a quasi-steady fashion were compared to measured data at the reduced frequency of 0.1 and showed relatively poor agreement. Pressure waveforms are shown that suggest shock phenomena may play an important part in the unsteady pressure response at some blade locations. Author

N86-27214*# Joint Inst. for Advancement of Flight Sciences, Hampton, Va.

INCOMPRESSIBLE BOUNDARY-LAYER STABILITY ANALYSIS OF LFC EXPERIMENTAL DATA FOR SUB-CRITICAL MACH NUMBERS M.S. Thesis

Scott A. Berry Jul. 1986 80 p

(Contract NCC1-24)

(NASA-CR-3999; NAS 1.26:3999) Avail: NTIS HC A05/MF A01 CSCL 01A

An incompressible boundary-layer stability analysis of Laminar Flow Control (LFC) experimental data was completed and the results are presented. This analysis was undertaken for three reasons: to study laminar boundary-layer stability on a modern swept LFC airfoil; to calculate incompressible design limits of linear stability theory as applied to a modern airfoil at high subsonic speeds; and to verify the use of linear stability theory as a design tool. The experimental data were taken from the slotted LFC experiment recently completed in the NASA Langley 8-Foot Transonic Pressure Tunnel. Linear stability theory was applied and the results were compared with transition data to arrive at correlated n-factors. Results of the analysis showed that for the configuration and cases studied, Tollmien-Schlichting (TS) amplification was the dominating disturbance influencing transition. For these cases, incompressible linear stability theory correlated with an n-factor for TS waves of approximately 10 at transition. The n-factor method correlated rather consistently to this value despite a number of non-ideal conditions which indicates the method is useful as a design tool for advanced laminar flow airfoils. Author

N86-27215# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

BLOWING MODEL FOR TURBULENT BOUNDARY-LAYER DUST INGESTION

Harold Mirels 10 Feb. 1986 38 p

(Contract F04701-85-C-0086)

(AD-A165074; TR-0086(6785)-1; SD-TR-85-97) Avail: NTIS HC A03/MF A01 CSCL 20/4

The rate at which dust is ingested into a turbulent boundary layer is deduced for the case of a semi-infinite flat plate and for the boundary layer behind a moving shock wave. Conventional turbulent boundary-layer theory is used. It is assumed that the local dust-ingestion rate corresponds to the blowing rate at which the local unblown surface shear C(f,0) is reduced to a value C(f,t) that is just sufficient to maintain surface particles in a mobile state. It is further assumed that the particle-velocity equilibration distance is small compared with the local boundary-layer thickness. It is found that erosion rate and boundary-layer thickness parameters are weakly (logarithmically) dependent on C(f,O)/C(f,t) and the maximum dust loading within the boundary layer is approximately equal to one. The theoretical predictions for local erosion rate, boundary thickness, and dust density are compared with the limited experimental results of Hartenbaum and Ausherman for the semi-infinite flat plate and moving-shock cases, respectively. Agreement within about a factor of two is obtained. Further comparison with experiment is recommended. GRA

N86-27216# Oak Ridge National Lab., Tenn.

THEORETICAL MODEL OF AERODYNAMIC FORCES AT HIGH SPEEDS AND ANGLE OF ATTACK IN A STRATIFIED FLOW-FIELD OF UF

G. J. Harloff Sep. 1985 39 p

(Contract DE-AC05-84OR-21400)

(DE86-005650; K/TS-11-732) Avail: NTIS HC A03/MF A01

A theoretical aerodynamic model of lift and drag forces on a flat plate at angle of attack and at hypersonic speeds is presented. Real gas effects and friction drag are accounted for. Theoretical results are presented as a function of the viscous interaction parameter. The performance for two geometries is presented. DOE

N86-27217# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

LA RECHERCHE AEROSPATIALE. BIMONTHLY BULLETIN, NO. 1984-6, NOVEMBER - DECEMBER 1984

Claude Sevestre, ed. Paris ESA May 1985 59 p Transl. into ENGLISH of La Recherche Aerospatiale. Bulletin Bimensuel (Paris, France), no. 1984-6, Nov. - Dec. 1984 Original language document was announced in IAA as A84-37528

(ESA-TT-907; ESA-85-95383) Avail: NTIS HC A04/MF A01; HC also available in English and French from ONERA, Paris FF 70

Turbulence models for a separated three dimensional turbulent boundary layer; a vortex point method for calculation of inviscid incompressible flows around rotary wings; effect of Reynolds number on the aerodynamic characteristics of an ogive-cylinder at high angle of attack; a hybrid finite difference-spectral method for computing compressible fluid flows; modeling the dynamic stall of the NACA 0012 profile; and helicopter noise are discussed. For individual titles, see N86-27218 through N86-27223.

N86-27218# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

CRITICAL EXAMINATION OF TURBULENCE MODELS FOR A SEPARATED THREE DIMENSIONAL TURBULENT BOUNDARY LAYER c34

R. Abid and R. Schmitt *In its* La Recherche Aerospatiale. Bimonthly Bulletin, no. 1984-6, November - December 1984 (ESA-TT-907) May 1985 11 p (For primary document see N86-27217 18-02) Avail: NTIS HC A04/MF A01; HC also available in English and French from ONERA, Paris FF 70

We propose to examine the behavior of several turbulence models in a 3 D turbulent boundary layer approaching separation. The incompressible test flow of Van den Berg et Elsenaar, which simulates a 3 D boundary layer under infinite swept wing conditions, was chosen to evaluate these models. An inverse calculation method is used to avoid singularities near the separation and thus permit a reliable critical examination of turbulence modeling. One algebraic turbulence model and three transport equation

models are evaluated in this study. The anisotropic eddy viscosity hypothesis introduced by Rotta is discussed in each case. Author

N86-27219# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A VORTEX POINT METHOD FOR CALCULATING INVISCID INCOMPRESSIBLE FLOWS AROUND ROTARY WINGS c34
B. Canatloube and S. Huberson *In its* La Recherche Aerospatiale. Bimonthly Bulletin, no. 1984-6, November - December 1984 (ESA-TT-907) May 1985 13 p Previously announced in IAA as A86-12021 (For primary document see N86-27217 18-02)
Avail: NTIS HC A04/MF A01; HC also available in English and French from ONERA, Paris FF 70

An integral method is presented for calculating incompressible inviscid unsteady flow around thin bodies in arbitrary motion, i.e., rotor blades in motion with respect to one another. Because an integral method is used, discretization is limited to the solid boundaries and the vortices. Boundary conditions are treated in terms of equation for the slipstream on the walls, the vorticity vector, a volume integral for the vorticity and a first-order Fredholm integral. The Helmholtz equation governs the evolution of vorticity, which forms a sheet of doublets. The pressure jumps on the blades are covered by the unsteady Bernoulli equation. Applications of the method to helicopter rotors, medium- and high-aspect ratio propellers and low-aspect ratio nautical propellers are demonstrated. M.S.K. (IAA)

N86-27220# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EFFECT OF THE REYNOLDS NUMBER ON THE AERODYNAMIC CHARACTERISTICS OF AN OGIVE-CYLINDER AT HIGH ANGLE OF ATTACK
P. Champigny *In its* La Recherche Aerospatiale. Bimonthly Bulletin, no. 1984-6, November - December 1984 (ESA-TT-907) May 1985 9 p Previously announced in IAA as A86-12022 (For primary document see N86-27217 18-02)
Avail: NTIS HC A04/MF A01; HC also available in English and French from ONERA, Paris FF 70

Low-speed wind tunnel data for an ogive model at high Angles Of Attack (AOA) are analyzed in terms of the flow separation regimes. The flows covered the Re range of 280,000-2 million, AOAs up to 80 deg and a Mach 0.35 flow velocity. The sting-mounted model was instrumented with 354 pressure taps. The data were used to calculate the normal and side forces. The drag coefficient was found to be dependent on the Re and the AOA. Both laminar and turbulent flows produced large side forces, which had cyclic distributions. Finally, the separations that occurred produced four types of flows for separate Re regimes. M.S.K. (IAA)

N86-27221# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A HYBRID SPECTRAL-FINITE DIFFERENCE METHOD FOR COMPUTING COMPRESSIBLE FLUID FLOWS
P. Loisel *In its* La Recherche Aerospatiale. Bimonthly Bulletin, no. 1984-6, November - December 1984 (ESA-TT-907) May 1985 11 p Previously announced in IAA as A86-12023 (For primary document see N86-27217 18-02)
Avail: NTIS HC A04/MF A01; HC also available in English and French from ONERA, Paris FF 70

A spectral method is described for solving the two-dimensional Navier-Stokes equations for viscous compressible flows with discontinuities. Momentum, mass and energy conservation equations are defined and applied in both one- and two-dimensional calculations. Comparisons are made between the efficacy of the spectral model in high gradient regions, using a Chebyshev collocation technique, and a finite difference method, involving a total variation diminishing scheme. The comparisons cover modeling of flows in a one-dimensional shock tube, a two-dimensional shock reflection and two-dimensional shock propagation. The spectral method contains Gibb oscillations and captures the shocks, and is more accurate where unsteady states border discontinuities. M.S.K. (IAA)

N86-27222# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DYNAMIC STALL MODELING OF THE NACA 0012 PROFILE
D. Petot *In its* La Recherche Aerospatiale. Bimonthly Bulletin, no. 1984-6, November - December 1984 (ESA-TT-907) May 1985 4 p Previously announced in IAA as A86-12024 (For primary document see N86-27217 18-02)
Avail: NTIS HC A04/MF A01; HC also available in English and French from ONERA, Paris FF 70

Correlations obtained by ONERA researchers in studies of large amplitude oscillations in airfoils are discussed. The correlation values were generated with a dynamic model for helicopter rotor blades experiencing nonlinear oscillations in the lift/angle of attack or moment/angle of attack hysteresis loops. Comparisons were made between the model predictions and data from NASA experiments with NACA 0012 airfoils at varying angles of attack, amplitudes and frequencies. The model proved adequate for predicting the hysteresis loops and in identifying stall behavior. M.S.K. (IAA)

N86-27223# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HELICOPTER NOISE
R. Legendre *In its* La Recherche Aerospatiale. Bimonthly Bulletin, no. 1984-6, November - December 1984 (ESA-TT-907) May 1985 3 p Previously announced in IAA as A86-12025 (For primary document see N86-27217 18-02)
Avail: NTIS HC A04/MF A01; HC also available in English and French from ONERA, Paris FF 70

The state of the art in predicting and modeling helicopter noise, its sources, components, magnitudes and dynamic characteristics, is assessed. Noise is not emitted by steady flow, and can be decomposed into noise and pseudo-noise. Account must be taken of pseudo-noise in considerations of passenger comfort. The evolution of vortices in the turbulent boundary layer, the turbulent wake and at the blade tips produces noise. The difficulty in predicting noise arises from the complex behavior of vortices, atmospheric processes which affect the noise during flight and interactions among noise effects of separate blades and the fuselage noise. Various experiments are suggested for deriving quantitative laws to improve noise prediction efforts. M.S.K. (IAA)

N86-27224# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Fluid Dynamics and Flight Mechanics Panel.
UNSTEADY AERODYNAMICS-FUNDAMENTALS AND APPLICATIONS TO AIRCRAFT DYNAMICS
Loughton, England Nov. 1985 620 p In ENGLISH and FRENCH Symposium held in Goettingen, West Germany, 6-9 May 1985 (AGARD-CP-386; ISBN-92-835-0382-1) Avail: NTIS HC A99/MF A01

Recent advances in the methods for experimentation and computational prediction of nonlinear flow phenomena in unsteady aerodynamics and of stability parameters required to describe adequately the dynamic behavior of aircraft with special emphasis on high angle-of-attack were examined. Topics addressed include: unsteady boundary layers; unsteady separation and stall; buffeting; unsteady airloads; wind tunnel and flight test techniques, with emphasis on the measurement of nonlinearities, aerodynamic cross-coupling, hysteresis, and time dependent effects; mathematical modeling; bifurcation theory; prediction of wing rock; and advanced control systems. For individual titles, see N86-27225 through N86-27266.

N86-27225# Technische Univ., Brunswick (West Germany). Inst. fuer Stroemungsmechanik.
UNSTEADY FLOWS: FUNDAMENTALS AND APPLICATIONS
B. Laschka *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 21 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

An introductory overview about the fundamental equations describing the special features of unsteady flows is presented.

Starting with the full Navier-Stokes equations different stages of reductions down to linear potential theory are evaluated. Their scope of validity is discussed. For viscous flows attention is given to the incompressible case whereas for inviscid flows compressibility was retained. Author

N86-27226# United Technologies Research Center, East Hartford, Conn.
DYNAMIC STALL OF SWEPT AND UNSWEPT OSCILLATING WINGS
Franklin O. Carta *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 15 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

Recent unsteady tests on oscillating tunnel-spanning wings (representative of full scale helicopter blades) have shown that the dynamic stall phenomena for a swept wing model is significantly different from that for an unswept wing. Several critical measurements and calculations relative to the behavior of the surface flow were made, including chordwise wave speed of the stalling vortex, the degree of pitch rate dependence of the vortex inception angle, and the ability of the cosine law for sweep to normalize unsteady poststall behavior, even after reattachment occurs. Finally, an examination of hot-film response data shows that the stagnation flow along the swept wing leading edge significantly alters the unsteady surface flow behavior in a narrow region along the leading edge when compared with data from the unswept wing. However, from approximately 15 percent chord and aft there appears to be no sweep effect, and the results from both wings are nearly indistinguishable. Author

N86-27227# Centre National de la Recherche Scientifique, Orsay (France).
UNSTEADY VISCOUS FLOW OF AN INCOMPRESSIBLE FLUID AROUND A PROFILE: A COMPARISON OF THEORY AND PRACTICE [ECOULEMENT INSTATIONNAIRE DECOLLE D'UN FLUIDE INCOMPRESSIBLE AUTOUR D'UN PROFIL: UNE COMPARISON THEORIE-EXPERIENCE]
O. Daube, Ta Phuoc Loc, P. Monnet (Poitiers Univ., France), and M. Coutanceau *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 14 p In FRENCH (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The results of numerical and experimental studies of the unsteady flow of a viscous incompressible fluid around a profile of high incidence were presented. Numerical simulation and experimental tests were used to analyze the correlation of the Navier-Stokes equation and Reynolds number at the transition phase. Transl. by T.R.

N86-27228# Vrije Universiteit, Brussels (Belgium). Dept. of Fluid Mechanics.
VELOCITY AND TURBULENCE MEASUREMENTS IN DYNAMICALLY STALLED BOUNDARY LAYERS ON AN OSCILLATING AIRFOIL
J. deRuyck and Ch. Hirsch *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 13 p Sponsored in part by Belgian National Research Funds (NFWO) (For primary document see N86-27224 18-02)
(Contract DAJA45-83-C-0021)
Avail: NTIS HC A99/MF A01

Detailed velocity and turbulence properties in the dynamically stalled boundary layer of an oscillating NACA 0012 airfoil were measured. The airfoil oscillated around an axis at 25% distance from the leading edge with a sinusoidal motion. Measurements are performed at eight chordwise positions, in non-stalled, stall onset, and deep stalled flow conditions. Instantaneous detailed flow and turbulence patterns of the periodic separation vortex are presented and discussed. Corresponding terms of the turbulent energy balance are derived and compared with flat plate boundary layer data. In particular, negative turbulent energy production is observed during vortex development. Author

N86-27229# Centre National de la Recherche Scientifique, Marseilles (France). Inst. de Mecanique des Fluides.
WING PROFILE IN STALLED POSITION SUBJECT TO A FLOW OF ALTERNATING POTENTIAL AND STRONG VORTEX [PROFIL D'AILE EN DECROCHAGE SOUMIS A UN ECOULEMENT ALTERNATIVEMENT POTENTIEL ET A FORT VORTICITE]
C. Maresca and D. Favier *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 15 p In FRENCH (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The aerodynamic behavior of a wing profile subject to a flow of alternating potential and strong vortex is examined. The simulation experiment consisted of placing a fixed wing profile in the wake of a profile that oscillated at stalling incidence parallel to the flow. The results show that the effects on the fixed profile may be theoretically approximated by considering the profile as isolated in the flow while the amplitude of the speed and the incidence are simultaneously variable with the pre-established values. Transl. by T.R.

N86-27230# Lockheed Missiles and Space Co., Sunnyvale, Calif.
A CRITICAL LOOK AT DYNAMIC SIMULATION OF VISCOUS FLOW
L. E. Ericsson *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 11 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

A critical examination is made of the classic role of the wind tunnel as a tool for simulation of the free flight aerodynamics. That the equivalence concept established for steady flow is not valid for unsteady flow is no great surprise. More surprising, probably, is the fact that simulation of the relative velocity time history, which assures simulation of the inviscid unsteady aerodynamics, will in many cases not assure simulation of the unsteady viscous flow. In the case of flow separation and associated hysteresis the lack of simulation of the transient viscous flow can sometimes even generate the incorrect final steady state flow condition. Only close attention to the simulation of the unsteady boundary condition at the vehicle surface can assure the utility of experimental and numerical results for prediction of full scale unsteady viscous flow characteristics. Author

N86-27231# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
UNSTEADY BOUNDARY-LAYER SEPARATION ON AIRFOILS PERFORMING LARGE-AMPLITUDE OSCILLATIONS: DYNAMIC STALL
W. Geissler *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 12 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

Experimental investigations have exposed a strong dependency of unsteady separation characteristics in the regime of dynamic stall on airfoil shape, Reynolds and Mach number, and frequency and time dependence incidence. A suitable prediction method should be able to account for these various parameters. Coupling procedures between two-dimensional unsteady boundary layers and inviscid surface singularity methods (panel methods) were developed for analytical investigation of unsteady turbulent separation. The influence of various parameters on unsteady separation is discussed in detail and comparison with experimental data is made. The results show that, even for weak coupling between boundary layer and inviscid boundary condition, good correspondence exists between theory and experiment with respect to the development of unsteady separation. Author

N86-27232*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPUTATIONAL ASPECTS OF UNSTEADY FLOWS
Tuncer Cebeci (Douglas Aircraft Co., Inc., Long Beach, Calif.), L. W. Carr, A. A. Khattab, and S. M. Schimke *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics

Nov. 1985 25 p (For primary document see N86-27224 18-02) (Contract F496720-82-C-0055)
Avail: NTIS HC A99/MF A01 CSCL 01A

The calculation of unsteady flows and the development of numerical methods for solving unsteady boundary layer equations and their application to the flows around important configurations such as oscillating airfoils are presented. A brief review of recent work is provided with emphasis on the need for numerical methods which can overcome possible problems associated with flow reversal and separation. The zig-zag and characteristic box schemes are described in this context, and when embodied in a method which permits interaction between solutions of inviscid and viscous equations, the characteristic box scheme is shown to avoid the singularity associated with boundary layer equations and prescribed pressure gradient. Calculations were performed for a cylinder started impulsively from rest and oscillating airfoils. The results are presented and discussed. It is conlcuded that turbulence models based on an algebraic specification of eddy viscosity can be adequate, that location of translation is important to the calculation of the location of flow separation and, therefore, to the overall lift of an oscillating airfoil. Author

N86-27233*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
UNSTEADY TURBULENT BOUNDARY-LAYER EXPERIMENTS WITH RAPIDLY CHANGING FREE-STREAM CONDITIONS
G. J. Brereton (Stanford Univ., Calif.), L. W. Carr, and W. C. Reynolds *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 9 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01 CSCL 01A

Selected data sets produced by the Stanford Unsteady Turbulent Boundary Layer Program are compared to analytic solutions of the Stokes equations for different kinds of imposed, organized unsteadiness. Good agreement is found, qualifying the facility as one that faithfully produces flows of different prescribed unsteady conditions. Data sets from the facility are therefore considered especially suitable for comparison with predictions of turbulence models for unsteady flows. New data describing the development of an unsteady separation bubble are presented. Author

N86-27234# Centre National de la Recherche Scientifique, Grenoble (France). Inst. de Mecanique.
EXPERIMENTAL STUDY OF UNSTEADY TURBULENT BOUNDARY LAYERS SUBJECT TO MEAN PRESSURE GRADIENTS OF ZERO OR POSITIVE [ETUDE EXPERIMENTALE DE COUCHES LIMITES TURBULENTES INSTATIONNAIRES SOUMISES A DES GRADIENTS DE PRESSION MOYENS NULS OU POSITIFS]
G. Binder, S. Tardu, R. Blackwelder, and J. L. Kueny *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 13 p In FRENCH (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The results of tests on turbulent flows in a fluid cycle, at the frequency and amplitude of the audible frequency range were presented. The results include velocity measurements using laser velocimeter equipment, as well as friction measurements using the hot film method. Transl. by T. R.

N86-27235# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et Recherches en Aerothermodyn.
UNSTEADY TURBULENT BOUNDARY LAYERS: EXPERIMENTAL AND NUMERICAL INVESTIGATIONS [COUCHE LIMITE TURBULENTE INSTATIONNAIRE: INVESTIGATIONS EXPERIMENTALE ET NUMERIQUE]
J. Cousteix and R. Houdeville *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 12 p In FRENCH (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The results of an experimental study of turbulent boundary layers subject to periodic external fluctuations of the flow are presented. Two cases are studied, one a flat plate and the other a pipe with a positive pressure gradient viscous flow. The unsteady boundary layer equations and their relationship with viscous flow is analyzed using integral equations. Transl. by T. R.

N86-27236# Mykytow (Walter J.), Weymouth, Mass.
REVIEW OF SMP 1984 SYMPOSIUM ON TRANSONIC UNSTEADY AERODYNAMICS AND ITS AEROELASTIC APPLICATIONS
Walter J. Mykytow *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 45 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The latest methods of predicting transonic unsteady airloads for oscillating surfaces and flutter were discussed. Also considered were aerolelastic applications, many of which were made to standard AGARD configurations. The 16 papers and the round table discussion were summarized for coordination with the Fluid Dynamics Panel and the Fluid Mechanics Panel. B.G.

N86-27237*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRANSONIC AERODYNAMIC AND AEROELASTIC CHARACTERISTICS OF A VARIABLE SWEEP WING
P. M. Goorjian, G. P. Guruswamy (Informatics, Inc., Palo Alto, Calif.), H. Ide (Rockwell International Corp., Los Angeles, Calif.), and G. Miller *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 15 p Previously announced as N85-25203 (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01 CSCL 01A

The flow over the B-1 wing is studied computationally, including the aeroelastic response of the wing. Computed results are compared with results from wind tunnel and flight tests for both low-sweep and high-sweep cases, at 25.0 and 67.5 deg., respectively, for selected transonic Mach numbers. The aerodynamic and aeroelastic computations are made by using the transonic unsteady code ATRAN3S. Steady aerodynamic computations compare well with wind tunnel results for the 25.0 deg sweep case and also for small angles of attack at the 67.5 deg sweep case. The aeroelastic response results show that the wing is stable at the low sweep angle for the calculation at the Mach number at which there is a shock wave. In the higher sweep case, for the higher angle of attack at which oscillations were observed in the flight and wind tunnel tests, the calculations do not show any shock waves. Their absence lends support to the hypothesis that the observed oscillations are due to the presence of leading edge separation vortices and are not due to shock wave motion as was previously proposed. Author

N86-27238# National Aerospace Lab., Amsterdam (Netherlands).
UNSTEADY AIRLOAD COMPUTATIONS FOR AIRFOIL OSCILLATING IN ATTACHED AND SEPARATED COMPRESSIBLE FLOW
R. Houwink *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 8 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

Recent developments in coupled inviscid flow-boundary layer computations are discussed for airfoils in unsteady motion in attached and separated subsonic and transonic flow. The applicability of quasi-simultaneous strong interaction coupling procedures for transonic small perturbation theory and boundary layer integral methods is illustrated for oscillating airfoils with shock-induced separation. The relevance of the predicted airloads for aeroelastic applications is illustrated using the analysis of an aeroelastic instability of a supercritical wing wind tunnel model. Author

N86-27239# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
WIND TUNNEL AND FLIGHT TEST ANALYSIS AND EVALUATION OF THE BUFFET PHENOMENA FOR THE ALPHA JET

TRANSONIC WING
H. Buers and V. Schmitt (Office National d'Etudes et de Recherches Aeronautiques, Paris, France) *In* AGARD Unsteady Aerodynamics-Fundamentals and Application to Aircraft Dynamics Nov. 1985 11 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

In addition to previous presentations of wind tunnel and flight test data of the Dornier Transsonischer Tragfluegel (TST) program, results of local flow surveys on the wing in the buffeting region are presented. The vibration levels on the wing and at the pilot's seat are also shown. The separated effects of the slats in use both with and without trailing edge flaps as maneuver flaps up to the transonic flight regime are presented. Author

N86-27240# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
UNSTEADY VORTEX AIRFOIL INTERACTION
G. E. A. Meier and R. Timm *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 10 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The unsteady flow in the vicinity of an airfoil in a subsonic flow with strong vortices is investigated for a two-dimensional problem. Emphasis was placed on the interaction of the passing vortex flow field with the steady flow field of the airfoil. Unsteady flow separation and generation of new vortices of the airfoil occurs depending on vortex strength and core path. Inviscid calculations of vortex paths and sound generation are compared with the experimental results. The associated pressure waves have a strong directivity. The vortices used for the interaction experiments are generated by different vortex shedding cylinders in a stationary duct flow or by airfoils in the starting flow of a shock-tube. High speed interferometric flow recording and wall pressure measurement are the main experimental techniques. Author

N86-27241# Westland Helicopters Ltd., Yeovil (England).
UNSTEADY AERODYNAMICS APPLICATION TO HELICOPTER NOISE AND VIBRATION SOURCES
T. S. Beddoes *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 10 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The feasibility of producing aerodynamic loads of sufficient fidelity to enable a realistic acoustic signal to be derived was studied. The need arises from the excessive blade/slap noise which results from blade/vortex interaction. A tool is required to investigate the influence of design and operational parameters as a routine procedure. For this purpose a simplified two dimensional model was developed and validated against a more sophisticated analysis. The model is extended to the rotor application where the complex wake geometry is the determining factor in the character of the loading. From the distributed transient loading an acoustic signal was derived which was compared with experimental data. A comprehensive correlation was not yet performed but the preliminary results are encouraging. Author

N86-27242*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RECENT DEVELOPMENTS IN ROTARY-BALANCE TESTING OF FIGHTER AIRCRAFT CONFIGURATIONS AT NASA AMES RESEARCH CENTER
Gerald N. Malcolm and Lewis B. Schiff *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 25 p Previously announced as N85-32090 (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01 CSCL 01A

Two rotary balance apparatuses were developed for testing airplane models in a coning motion. A large scale apparatus, developed for use in the 12-foot Pressure Wind Tunnel primarily to permit testing at high Reynolds numbers, was recently used to investigate the aerodynamics of 0.05-scale model of the F-15 fighter aircraft. Effects of Reynolds number, spin rate parameter, model attitude, presence of a nose boom, and model/sting mounting angle were investigated. A smaller apparatus, which investigates the aerodynamics of bodies of revolution in a coning motion, was used in the 6-by-6 foot Supersonic Wind Tunnel to investigate the aerodynamic behavior of a simple representation of a modern fighter, the Standard Dynamic Model (SDM). Effects of spin rate parameter and model attitude were investigated. A description of the two rigs and a discussion of some of the results obtained in the respective tests are presented. Author

N86-27243# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
NEW ROTARY RIG AT RAE AND EXPERIMENTS ON HIRM
C. O. OLeary and E. N. Rowthorn *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 14 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

A rig for measurement of forces and moments due to continuous rate of roll was commissioned at Royal Aircraft Establishment, Bedford. Tests were made on a High Incidence Research Model (HIRM) in two wind tunnels at M = 0.2, 0.4, and 0.7. At present models can be tested up to 40 deg angle of attack at rotational speeds up to 350 rpm. Tests on HIRM included an investigation of configuration and Reynolds number effects. Results are compared with similar data from tests with another rolling rig and from small amplitude oscillatory tests. Author

N86-27244# Aeronautical Research Inst. of Sweden, Bromma.
NEW DYNAMIC TESTING TECHNIQUES AND RELATED RESULTS AT FFA
Torulf Jansson and Lars Torngren *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 14 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

Extraction of dynamic derivatives from wind tunnel testing was emphasized in recent years. This is shown from the number of different rigs developed and in use, both in the subsonic and transonic wind tunnels. Brief descriptions of the different rigs, testing procedures and data handling were given. A wide survey of the different rigs used for dynamic derivative testing and the corresponding testing capability are presented. B.G.

N86-27245# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
STANDARD DYNAMICS MODEL EXPERIMENTS WITH THE DFVLR/AVA TRANSONIC DERIVATIVE BALANCE
E. Schmidt *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 16 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

A slender high-load forced-oscillation measuring system for dynamic derivatives of aircraft and missile models in a transonic wind tunnel is presented together with typical test results of the significant aerodynamic coefficients and stability derivatives of the Standard Dynamics Model, a simplified fighter aircraft model with a wing span of 0.345 m. The measurements in the rotational modes pitch, yaw, and roll encompass Mach numbers from 0.6 to 1.2, angles of attack from 0 to 30 degrees, and excitation frequencies from 2 to 20 Hz at a constant Reynolds number of 7.8 Mio/m. Most of the stiffness and damping derivatives gathered show substantial nonlinear dependence on Mach number and angle of attack, whereas the influence of reduced frequency is less prominent. The results are closely related to published measurements on Standard Dynamic Models performed in other NATO countries. Author

N86-27246# Institut de Mecanique des Fluides de Lille (France).
RECENT DEVELOPMENTS IN TECHNIQUES FOR DYNAMIC SIMULATION FOR THE IDENTIFICATION OF STABILITY PARAMETERS [RECENTS DEVELOPPEMENTS DES TECHNIQUES DE SIMULATION DYNAMIQUE APPLIQUEES A L'IDENTIFICATION DES PARAMETRES DE STABILITE]
D. Tristrant and O. Renier *In* AGARD Unsteady Aerodynamics-

Fundamentals and Applications to Aircraft Dynamics Nov. 1985 14 p In FRENCH (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

In the aircraft dynamic behavior prediction context, experimental methods and analytical procedures which allow mathematical linear modeling parameters to be identified, using a test apparatus located at the Institut de Mecanique des Fluides de Lille is presented. The rig characteristics, the experimental procedures, the identification methods, and results from different aircraft models will be described. Emphasis is put on the interest of a specifc lambda degree of freedom angle formed by the rotational vector and velocity vector. Effectively, it is shown that rotational tests with a non zero value of lambda offer interesting possibilities for identification and allow the estimation of linear model parameters in the case of a quasi-linear path. A different degree of freedom, called gyration radius, was obtained by fixing a special mechanism onto the test apparatus. By carrying out a carefully selected test program, this degree of freedom allows the whole set of stability parameters to be identified, given the structure of the linear mathematical model. Finally, dynamic measures obtained during oscillatory coning using a complete aircraft model produced in evidence the large amplitude of unsteady aerodynamic phenomena at high angles of attack, which could not be ignored if prediction of post stall evolutions is sought. Author

N86-27247# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
GENERATION OF TWO-DIMENSIONAL GUST FIELDS IN SUBSONIC WIND-TUNNELS
B. Krag and W. Wegner (Technische Univ., Brunswick, West Germany) *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 12 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

For a variety of flight vehicles, problems during flight in turbulence at subsonic speeds are expected: mainly slow flying helicopters, tilt rotorcraft, aircraft maneuvering at high angles of attack, wing in ground effect vehicles, and aircraft with active controlled wings. The investigation of these problems posses large difficulties. The analyst rapidly enters domains where computational methods fail and where wind tunnel experiments are necessary. This raises the problem of stimulating atmospheric turbulence in a wind tunnel. Until now, no fundamental investigations of the problem of gust generation in wind tunnels were undertaken. Investigations of gust generations were started in a model subsonic wind tunnel. In order to recognize the influence of the main parameters, like number of lift generating wings, chord length, trailing edge-flap or jet-flap, constant chord wing or side-wall mounted winglets, four different types of gust generators were investigated. The gust field was harmonically oscillating. Frequency response measurements of the gust angle of attack were made, covering the complete volume of the test section. Additionally the flow field in the wind tunnel behind harmonically oscillating gust generator flaps was calculated. The results were compared with the measurements. Author

N86-27248*# National Aeronautics and Space Administration. Dryden (Hugh L.) Flight Research Center, Edwards, Calif.
EXTRACTION OF AERODYNAMIC PARAMETERS FOR AIRCRAFT AT EXTREME FLIGHT CONDITIONS
Kenneth W. Iliff *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 21 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01 CSCL 01A

The maximum likelihood estimator was used to extract stability and control derivatives from flight data for many years. Most of the literature on aircraft estimation concentrates on new development and applications, assuming familiarity with basic concepts. The maximum likelihood estimator and the aircraft equations of motion that the estimator uses are discussed. The current strength and limitations associated with obtaining flight-determined aerodynamic coefficients in extreme flight conditions are assessed. The importance of the careful combining of wind tunnel results (or calculations) and flight results and the thorough evaluation of the mathematical model is emphasized. The basic concepts of minimization and estimation are examined for a simple computed aircraft example, and the cost functions that are to be minimized during estimation are defined and discussed. Graphic representations of the cost functions are given to help illustrate the minimization process. Finally, the basic concepts are generalized, and estimation of stability and control derivatives from flight data is discussed. Author

N86-27249*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NONLINEAR PROBLEMS IN FLIGHT DYNAMICS INVOLVING AERODYNAMIC BIFURCATIONS
Murray Tobak and Gary T. Chapman *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 15 p Previously announced as N85-25206 (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01 CSCL 01A

Aerodynamic bifurcation is defined as the replacement of an unstable equilibrium flow by a new stable equilibrium flow at a critical value of a parameter. A mathematical model of the aerodynamic contribution to the aircraft's equations of motion is amended to accommodate aerodynamic bifurcations. Important bifurcations such as, the onset of large-scale vortex shedding are defined. The amended mathematical model is capable of incorporating various forms of aerodynamic responses, including those associated with dynamic stall of airfoils. E.A.K.

N86-27250*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BIFURCATION THEORY APPLIED TO AIRCRAFT MOTIONS
W. H. Hui (Waterloo Univ., Ontario) and Murray Tobak *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 14 p Previously announced as N85-23705 (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01 CSCL 01A

The bifurcation theory is used to analyze the nonlinear dynamic stability characteristics of single-degree-of-freedom motions of an aircraft or a flap about a trim position. The bifurcation theory analysis reveals that when the bifurcation parameter, e.g., the angle of attack, is increased beyond a critical value at which the aerodynamic damping vanishes, a new solution representing finite-amplitude periodic motion bifurcates from the previously stable steady motion. The sign of a simple criterion, cast in terms of aerodynamic properties, determines whether the bifurcating solution is stable (supercritical) or unstable (critical). For the pitching motion of a flap-plate airfoil flying at supersonic/hypersonic speed, and for oscillation of a flap at transonic speed, the bifurcation is subcritical, implying either that exchanges of stability between steady and periodic motion are accompanied by hysteresis phenomena, or that potentially large aperiodic departures from steady motion may develop. On the other hand, for the rolling oscillation of a slender delta wing in subsonic flight (wing rock), the bifurcation is found to be supercritical. This and the predicted amplitude of the bifurcation periodic motion are in good agreement with the experiments. Author

N86-27251# National Research Council of Canada, Ottawa (Ontario).
DYNAMIC NONLINEAR AIRLOADS: REPRESENTATION AND MEASUREMENT
E. S. Hanff *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 14 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

A new representation of aerodynamic reactions (in terms of the motion variables), which does not rely on assumptions of linearity, is proposed. This representation is, therefore, indicated for extreme flight conditions where a locally linearized model is usually of questionable value. The significance within the present context of stability derivatives is discussed with the intention of

pointing out their range of applicability. A wind tunnel technique, capable of efficiently obtaining the bulk of the data required for the effective use of the representation is briefly described. Author

N86-27252*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RECENT EXPERIENCES OF UNSTEADY AERODYNAMIC EFFECTS ON AIRCRAFT FLIGHT DYNAMICS AT HIGH ANGLE OF ATTACK
Luat T. Nguyen, Raymond D. Whipple, and Jay M. Brandon *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 25 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

Recent research is highlighted which was conducted at the NASA Langley Research Center on two high angle-of-attack flight dynamic phenomena which are dominated by unsteady aerodynamic effects: wing rock and tumbling. Studies of wing rock induced by strong vortical flows and tumbling characteristics observed on an advanced configuration are reviewed. Results of wind tunnel experiments are summarized and the aerodynamic mechanisms involved in the phenomena were discussed. Author

N86-27253# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Avionics Lab.
UNSTEADY AERODYNAMICS AND DYNAMIC AIRCRAFT MANEUVERABILITY
James D. Lang and Michael S. Francis (Air Force Space Div., Los Angeles, Calif.) *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 19 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

A forecast of future aerial combat predicated on anticipated technological advances and weapons developments suggests a need for supermaneuverable aircraft possessing greatly enhanced turning and virtually instantaneous point-and-shoot capabilities. The potential advantage of exploiting this unique flight environment was discussed along with a detailed description of expected vehicle dynamic behavior. An emerging picture of the unsteady aerodynamic behavior which will be experienced during these violent maneuvers dictates a need for greater vehicle and flow field control capabilities far in excess of any previously employed in application. However, the successful implementation of advanced control techniques may well beneficially exploit the unusual flow phenomena associated with this nonclassical method of flight. The research discoveries and developmental ideas generated during the next decade will likely alter the concept of maneuvering flight as it is known and lead to a new generation of aircraft with vastly improved combat capabilities. Author

N86-27254# London Univ. (England). Dept. of Aeronautical Engineering.
ON THE INTERFACE BETWEEN UNSTEADY AERODYNAMICS, DYNAMICS AND CONTROL
G. J. Hancock and R. Vepa *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 12 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The problems of interfacing the mathematical representation of linearized unsteady aerodynamics with dynamic response such that the eigenvalue of the dynamic response are correctly obtained. These eigenvalues are then used in control synthesis. Particular attention is paid to C sub M2 (lag effect between the main wing and tail) in the context of aircraft dynamics. The concept of quasi-steady aerodynamics is clarified. Author

N86-27255# Royal Aircraft Establishment, Farnborough (England).
CORRELATION OF PREDICTED AND FREE-FLIGHT RESPONSES NEAR DEPARTURE CONDITIONS OF A HIGH INCIDENCE RESEARCH MODEL
A. Jean Ross and Geraldine F. Edwards *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 13 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The mathematical model of aerodynamic forces and moments is described, based on results from various wind tunnel experiments with the Royal Airforce Establishment High Incidence Research Model (HIRM). Simulations of the responses due to longitudinal and lateral control inputs at high angles of attack are compared with the responses measured on free-flight models of the configuration. The main features of the flight behavior are reproduced, in particular such phenomena as roll-off, wing rock, and nose slice. Author

N86-27256# Kansas Univ., Lawrence. Dept. of Aerospace Engineering.
THEORETICAL PREDICTION OF WING ROCKING
C. Edward Lan *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 13 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

Wing rock is primarily a rolling oscillation about the longitudinal body axis at high angles of attack. It involves nonlinear interaction between flight dynamics and aerodynamics. A nonlinear aerodynamic model was proposed earlier to predict the wing rock frequency and amplitude of low aspect-ratio configurations with good accuracy. The theory is applied to a twin-jet fighter aircraft of moderate aspect ratio and to a low-speed configuration of high aspect ratio. For the purpose of predicting necessary aerodynamic derivatives, a lifting surface method coupled with nonlinear airfoil section data is developed. The results show that wing rock can be predicted with the present wing-rock and aerodynamic theories. It is also found that for configurations of high aspect ratio, the one degree of freedom dynamic model in the present wing rock theory should be used. For other configurations, the three degrees of freedom model is more appropriate. Author

N86-27257# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
EFFECTS OF AERODYNAMIC LAGS ON AIRCRAFT RESPONSES
J. C. vanderVaart *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 11 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

Results of a theoretical study on the effects of unsteady aerodynamics on symmetric aircraft responses due to elevator and vertical turbulence imputs, are presented. Several linear models were developed to describe unsteady lift and downwash and delays due to horizontal tail length. Results for three example aircraft types show that calculated normal acceleration levels due to turbulence are very little affected by including unsteady wing lift and downwash. However, there appears to be a noticeable influence on plunging acceleration and pitch rate response to elevator or vertical turbulence inputs. Author

N86-27258# Smith Associates Consulting System Engineers Ltd., Cobham (England).
A SELF-ORGANISING CONTROL SYSTEM FOR NON-LINEAR AIRCRAFT DYNAMICS
C. Evans *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 12 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

At high angles of attack (AOA) flow separations can produce nonlinear and time varying aerodynamic loads, which cannot be predicted with great certainty. Such loads make control system development extremely difficult. A control system was developed which can accomplish on-line reduction of the a priori uncertainties pertaining to the effective control of the aircraft. The self-organizing control system was developed to suppress unacceptable pitch-up tendencies of an aircraft at high AOA, without the use of AOA measurement. The final control system demonstrated good performance for a variety of inputs although performance was not as good in turbulence. Author

N86-27259# Messerschmitt-Boelkow G.m.b.H., Munich (West Germany). Hubschrauber und Flugzeuge.
GUST ALLEVIATION ON A TRANSPORT AIRPLANE
J. Becker, F. Weiss, E. Cavatorta (Aeritalia S.p.A., Naples, Italy), and C. Caldarelli *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 9 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

A Gust Alleviation System on a preliminary configuration of a commuter aircraft was analyzed. The analysis takes into account the influence of the elasticity of the aircraft, unsteady aerodynamic effect, and mechanical nonlinearities such as backlash-deadzone, control surface rate, and deflection limitations. A relatively simple model shows that ride comfort can be improved by at least 50%. Author

N86-27260# Waterloo Univ. (Ontario). Dept. of Applied Mathematics and Mechanical Engineering.
UNSTEADY THREE-DIMENSIONAL FLOW THEORY VIA MATERIAL FUNCTIONS
W. H. Hui and H. J. VanRoessel *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 3 p (For primary document see N86-27224 18-02)
(Grant NAGw-575)
Avail: NTIS HC A99/MF A01

A new Lagrangian formulation for unsteady three dimensional supersonic inviscid flow over rigid bodies is developed. The continuity equation is eliminated by the use of material functions, a generalization of the stream functions for steady flow. This is followed by a transformation to new independent variables, three of which are these material functions. The fourth variable is a Lagrangian time distinct from the Eulerian time. This simultaneous use of both Langrangian and Eulerian time allows the problem of flow with shock wave to be reduced to a fixed boundary one. In the Newtonian limit it is found possible to obtain analytic solutions for various body shapes. Author

N86-27261*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
UNSTEADY INTERACTIONS OF TRANSONIC AIRFOILS WITH GUSTS AND CONCENTRATED VORTICES
W. J. McCroskey and G. R. Srinivasan (JAI Associates, Mountain View, Calif.) *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 13 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

Unsteady interactions of strong concentrated vortices, distributed gusts, and sharp-edged gusts with stationary airfoils were analyzed in two-dimensional transonic flow. A simple and efficient method for introducing such vortical disturbances was implemented in numerical codes that range from inviscid, transonic small-disturbance to thin-layer Navier Stokes. The numerical results demonstrate the large distortions in the overall flow field and in the surface air loads that are produced by various vortical interactions. The results of the different codes are in excellent qualitative agreement, but, as might be expected, the transonic small-disturbance calculations are deficient in the important region near the leading edge. Author

N86-27262# Hellenic Air Force Technology Research Center, Athens (Greece).
MODELLING OF THE VORTEX-AIRFOIL INTERACTION
Argyris G. Panaras *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 16 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

A modeling of the vortex-airfoil interaction is presented in which the finite-area of the real vortices is taken into consideration. Two vortex models are used. In the first, a disturbed piece of vorticity layer is simulated by four rows of discrete vortices of small strength. In the second, a number of discrete vortices is arranged within a circle. The first model may simulate a shear layer or a wake, while the second, a well-formed vortex. The method was applied to the calculation of the pressure induced on the surface of the airfoil by the interacting vortex. Both models give similar results. It was found that for large distances of the vortex from the surface of the airfoil, the consideration or not of the finite-area of the vortex is not a significant factor in determining the induced pressure field. However, when the distance of the vortex from the surface is reduced, its shape is distorted and the induced pressure pulses have lower amplitude than the ones induced by an equivalent point vortex. In the limit, where the vortex impinges on the leading edge of the airfoil, it is split into two and the time dependent pressure coefficient takes even negative values at some time intervals. Author

N86-27263# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
IDENTIFICATION OF AIRCRAFT CHARACTERISTICS INCLUDING GUST INDUCED DYNAMIC EFFECTS
D. Rohlf *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 8 p (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

For the investigation of unsteady aerodynamic effects at low Mach numbers, dynamic tests using controllable models of a light transport aircraft were performed in wind tunnels in the Dynamic Simulation Facility (Germany) and the Free Flight Catapult Facility (France). These model test techniques have the advantage of laboratory conditions with the possibility of generating reproducible gusts. The achieved flight test data were analyzed in detail applying method of system identification. This included the determination of the discrete gust disturbance from onboard measured signals. An approach was presented which used the measured angle of attack and additional calculated dynamic terms, which become essential in the presence of fast flow changes due to short-wave gusts or high-frequency control deflection. Measured time histories of model flight tests with excitation by control inputs and gusts are presented and compared with identification results obtained from the multi-run evaluation. Author

N86-27264# Sherbrooke Univ. (Quebec). Dept. de Genie Mecanique.
EXPERIMENTAL STUDY OF THE EFFECT OF TURBULENCE ON DYNAMIC STALLING [ETUDE EXPERIMENTALE DE L'EFFET DE LA TURBULENCE SUR LE DECROCHAGE DYNAMIQUE]
A. Laneville, P. Vittecoq, and J. Cote *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 7 p In FRENCH (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The results of a study of dynamic stalling for different intensities of turbulence in the flow of a wind tunnel are presented. The test was conducted on a NACA 0018 profile with sinusoidal oscillation. The results show that turbulence modifies both static and dynamic stall phenomena. It is shown that turbulence stabilizes the boundary layer at the leading edge, while allowing the profile to attain larger angles of incidence before stalling. In addition, turbulence alters the formation of vortices at the leading edge. Transl. by T. R.

N86-27265*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATION OF CFD TECHNIQUES TOWARD THE VALIDATION OF NONLINEAR AERODYNAMIC MODELS
Lewis B. Schiff and Joseph Katz *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 15 p Previously announced as N85-26671 (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01 CSCL 14B

Applications of computational fluid dynamics (CFD) methods to determine the regimes of applicability of nonlinear models describing the unsteady aerodynamic responses to aircraft flight motions are described. The potential advantages of computational methods over experimental methods are discussed and the

concepts underlying mathematical modeling are reviewed. The economic and conceptual advantages of the modeling procedure over coupled, simultaneous solutions of the gas dynamic equations and the vehicle's kinematic equations of motion are discussed. The modeling approach, when valid, eliminates the need for costly repetitive computation of flow field solutions. For the test cases considered, the aerodynamic modeling approach is shown to be valid. Author

N86-27266# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
STUDY OF THE TRANSITION BEHAVIOR OF AN AIRPLANE IN THE VICINITY OF BIFURCATION POINTS [ETUDE DU COMPORTEMENT TRANSITOIRE D'UN AVION AU VOISINAGE DE POINTS DE BIFURCATION]
P. Guicheteau *In* AGARD Unsteady Aerodynamics-Fundamentals and Applications to Aircraft Dynamics Nov. 1985 7 p In FRENCH (For primary document see N86-27224 18-02)
Avail: NTIS HC A99/MF A01

The transition behavior of an aircraft in the vicinity of bifurcation points, using a differential system method to analytically determine nonlinearities is discussed. The method proposed does not require the reduction of the differential system. Primary applications for this method include studies on fighter aircraft. Transl. by T. R.

N86-27652*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SHUTTLE TETHERED AEROTHERMODYNAMICS RESEARCH FACILTY (STARFAC) INSTRUMENTATION REQUIREMENTS
George M. Wood, Paul M. Siemers, Giovanni M. Carlomagno (Naples Univ. (Italy).), and John Hoffman (Texas Univ., Dallas.) *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 251-263 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

N86-27653*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SHUTTLE TETHERED AEROTHERMODYNAMICS RESEARCH FACILITY (STARFAC)
Paul M. Siemers, George M. Wood, and Henry Wolf *In* NASA. Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 265-285 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N86-27267# National Transportation Safety Board, Washington, D. C.
NATIONAL TRANSPORTATION SAFETY BOARD SAFETY RECOMMENDATION
4 Mar. 1986 6 p
(NTSB-4102C/300A) Avail: NTIS HC A02/MF A01

Vibrations caused by open air start access doors on Lockheed Electras were discussed. Proposed safety measures include: issuance of an Airworthiness Directive to all Electra operators to modify the air start access door; until modification of the door occurs, Principle Operations Inspectors should inform the operators of the potential hazards; establish procedures to ensure adequate surveillance is maintained; verification that supplemental operators are fulfilling their responsibility to see that competent personnel are available to maintain and service the aircraft; evaluate information needed by the crash/fire rescue agencies; and provide guidance on topics and training in cockpit resource management to flightcrew members. B.G.

N86-27268*# Wichita State Univ., Kans. Coll. of Engineering.
ANALYSES AND TESTS FOR DESIGN OF AN ELECTRO-IMPULSE DE-ICING SYSTEM Interim Report
G. W. Zumwalt, R. L. Schrag, W. D. Bernhart, and R. A. Friedberg May 1985 198 p
(Grant NAG3-284)
(NASA-CR-174919; AR-85-1; NAS 1.26:174919) Avail: NTIS HC A09/MF A01 CSCL 01C

De-icing of aircraft by using the electro-magnetic impulse phenomenon was proposed and demonstrated in several European countries. However, it is not available as a developed system due to lack of research on the basic physical mechanisms and necessary design parameters. The de-icing is accomplished by rapidly discharging high voltage capacitors into a wire coil rigidly supported just inside the aircraft skin. Induced eddy currents in the skin create a repulsive force resulting in a hammer-like force which cracks, de-bonds, and expels ice on the skin surface. The promised advantages are very low energy, high reliability of de-icing, and low maintenance. Three years of Electo-Impulse De-icing (EIDI) research is summarized and the analytical studies and results of testing done in the laboratory, in the NASA Icing Research Tunnel, and in flight are presented. If properly designed, EIDI was demonstrated to be an effective and practical ice protection system for small aircraft, turbojet engine inlets, elements of transport aircraft, and shows promise for use on helicopter rotor blades. Included are practical techniques of fabrication of impulse coils and their mountings. The use of EIDI with nonmetallic surface materials is also described. Author

N86-27269# National Transportation Safety Board, Washington, D. C. Bureau of Field Operations.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AND FOREIGN AVIATION, ISSUE NUMBER 17 OF 1983 ACCIDENTS
12 Jul. 1985 337 p
(PB85-916918; NTSB/AAB-85/18) Avail: NTIS HC A15/MF A01; also available on subscription, North American Continent HC $185.00/year; all others write for quote CSCL 01B

The publication contains selected aircraft accident reports in Brief Format occurring in U.S. civil and foreign aviation operations during Calendar Year 1983. Approximately 200 General Aviation and Air Carrier accidents contained in the publication represent a random selection. The publication is issued irregularly, normally eighteen times each year. The Brief Format represents the facts, conditions, circumstances and probable cause(s) for each accident. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N86-27270* National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH DYNAMIC GLOBAL POSITIONING SYSTEM RECEIVER Patent
William J. Hurd, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena) Issued 25 Mar. 1986 13 p Filed 14 Nov. 1983 Supersedes N84-12151 (22 - 03, p 330) Sponsored by NASA. Pasadena Office
(NASA-Case-NPO-16171-1CU; US-Patent-4,578,678;
US-Patent-Appl-SN-551536; US-Patent-Class-343-357;
US-Patent-Class-343-418) Avail: US Patent and Trademark Office CSCL 17G

A Global Positioning System (GPS) receiver having a number of channels, receives an aggregate of pseudorange code time

division modulated signals. The aggregate is converted to baseband and then to digital form for separate processing in the separate channels. A fast fourier transform processor computes the signal energy as a function of Doppler frequency for each correlation lag, and a range and frequency estimator computes estimates of pseudorange, and frequency. Raw estimates from all channels are used to estimate receiver position, velocity, clock offset and clock rate offset in a conventional navigation and control unit, and based on the unit that computes smoothed estimates for the next measurement interval. NASA

N86-27271*# Princeton Univ., N. J. School of Engineering and Applied Science.
AN OPTIMIZATION MODEL FOR THE US AIR-TRAFFIC SYSTEM Final Report
John M. Mulvey Apr. 1986 27 p
(Grant NAG1-520)
(NASA-CR-177277; NAS 1.26:177277) Avail: NTIS HC A03/MF A01 CSCL 17G

A systematic approach for monitoring U.S. air traffic was developed in the context of system-wide planning and control. Towards this end, a network optimization model with nonlinear objectives was chosen as the central element in the planning/control system. The network representation was selected because: (1) it provides a comprehensive structure for depicting essential aspects of the air traffic system, (2) it can be solved efficiently for large scale problems, and (3) the design can be easily communicated to non-technical users through computer graphics. Briefly, the network planning models consider the flow of traffic through a graph as the basic structure. Nodes depict locations and time periods for either individual planes or for aggregated groups of airplanes. Arcs define variables as actual airplanes flying through space or as delays across time periods. As such, a special case of the network can be used to model the so called flow control problem. Due to the large number of interacting variables and the difficulty in subdividing the problem into relatively independent subproblems, an integrated model was designed which will depict the entire high level (above 29000 feet) jet route system for the 48 contiguous states in the U.S. As a first step in demonstrating the concept's feasibility a nonlinear risk/cost model was developed for the Indianapolis Airspace. The nonlinear network program --NLPNETG-- was employed in solving the resulting test cases. This optimization program uses the Truncated-Newton method (quadratic approximation) for determining the search direction at each iteration in the nonlinear algorithm. It was shown that aircraft could be re-routed in an optimal fashion whenever traffic congestion increased beyond an acceptable level, as measured by the nonlinear risk function. B.W.

N86-27272# Massachusetts Inst. of Tech., Lexington.
TCAS EXPERIMENTAL UNIT (TEU) HARDWARE DESCRIPTION
David A. Spencer, Raymond R. LaFrey, Joseph DiBartolo, and William H. Harman 6 Jun. 1986 129 p
(Contracts F19628-85-C-0002; DOT-FA77WAI-817)
(FAA/PM-85/2; PR-ATC-133) Avail: NTIS HC A07/MF A01

The hardware design of the TCAS Experimental Units (TEU's) constructed by Lincoln Laboratory to support the design and validation of the Traffic Alert and Collision Avoidance System (TCAS) for the FAA is described. Section 1.0 presents an overview of the operation of the TEU's in order to give some context for the hardware design. References are given to more extensive descriptions of the TCAS system operation and software design. Section 2.0 constitutes the bulk of the report, and is a detailed description of the TEU hardware design. The purpose of this description is to document the design details of the equipment which was used to develop and validate the signal processing techniques and algorithms which appear in the TCAS II Minimum Operational Performance Standard, the TCAS National Standard and various technique reports listed in the references. A second purpose is to provide design guidance to potential TCAS II manufacturers, in the form of a detailed description of a feasible design with documented performance. Finally, this document is a manual for future use and maintenance of the TEU's. Author

N86-27273# Federal Aviation Agency, Atlantic City, N.J.
TECHNICAL SUPPORT OF THE WALL STREET/BATTERY PARK CITY HELIPORT MLS (MICROWAVE LANDING SYSTEM) PROJECT Technical Note, Jan. - Jun. 1985
Barry R. Billmann, James H. Enias, and Michael Webb Dec. 1985 78 p
(AD-A165073; DOT/FAA/CT-TN85/58) Avail: NTIS HC A05/MF A01 CSCL 17/7

During the winter and spring of 1985, the Federal Aviation Administration (FAA) Eastern Region in conjunction with the Guidance and Airborne Systems Branch at the FAA Technical Center conducted a demonstration of a Microwave Landing System (MLS) located at a downtown heliport. This report describes both the industry/user and FAA Technical Center activities during the evaluation period. It describes the evaluation methodology and addresses topics concerning both technical and operational issues. It also describes the helicopter procedures flown during this evaluation and provides an analysis of signal coverage and the user's subjective opinions concerning the acceptability and perceived workload associated with these procedures. It was concluded that MLS to heliports is a viable asset to the helicopter Instrument Flight Rules (IFR) community; however, its full benefits may not be realized in the Battery Park/Wall Street area without revisiting the necessity and demand for the New York Terminal Control Area (TCA) Visual Flight Rules (VFR) operating exclusion area. Author (GRA)

N86-27274# Oak Ridge National Lab., Tenn.
LEARNED NAVIGATION PATHS FOR A ROBOT IN UNEXPLORED TERRAIN
S. S. Iyengar, C. C. Jorgensen, S. V. N. Rao, and C. R. Weisbin 1985 9 p Presented at the 2nd Conference on Artificial Intelligence Applications, Miami Beach, Fla., 11 Dec. 1985
(Contract DE-AC05-84OR-21400)
(DE86-001358; CONF-851245-1) Avail: NTIS HC A02/MF A01

Finding optimal paths for robot navigation in known terrain has been studied for some time but, in many important situations, a robot would be required to navigate in completely new or partially explored terrain. We propose a method of robot navigation which requires no pre-learned model, makes maximal use of available information, records and synthesizes information from multiple journeys, and contains concepts of learning that allow for continuous transition from local to global path optimality. The model of the terrain consists of a spatial graph and a Voronoi diagram. Using acquired sensor data, polygonal boundaries containing perceived obstacles shrink to approximate the actual obstacle surfaces, free space for transit is correspondingly enlarged, and additional nodes and edges are recorded based on path intersections and stop points. Navigation planning is gradually accelerated with experience since improved global map information minimizes the need for further sensor data acquisition. Our method currently assumes obstacle locations are unchanging, navigation can be successfully conducted using two-dimensional projections, and sensor information is precise. DOE

N86-27275# Litton Technische Werke, Freiburg (West Germany).
IMPROVEMENT OF STRAPDOWN SYSTEM PERFORMANCE BY MEANS OF NUMERICAL METHODS Final Report, Dec. 1984
Hermann Buitkamp, Klaus Enderlein, Glynn Everett, Uwe Kirchhoff, Michael Kleinschmidt, Demir Ozdes, and Peter Steiert Bonn Bundesministerium fuer Forschung und Technologie Nov. 1985 130 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-011; ISSN-0170-1339; LITEF-105-793) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 27.50

Software methods to improve the performance of strapdown systems, and the simulation tools used in the analysis of system mechanisms are presented. Models of the inertial and external sensors to compensate for systematic errors; correct timing of

the data flow of the sensors; multiposition alignment to eliminate the day-to-day repeatability of gyro biases; design control loops with optimal/suboptimal filters for special tasks of a strapdown unit (e.g., helicopter mission, initial alignment) are described. Kalman filters are used to reduce the influence of stochastic errors and for cross calibration of the sensors. ESA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-27276# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
COMBAT LOADS ON MODERN FIGHTERS
Feb. 1986 21 p
(AGARD-R-730; ISBN-92-835-1518-8) Avail: NTIS HC A02/MF A01

A number of factors which influence the selection of design cases are examined in the light of modern fighter usage and modern technologies that are available, or will soon be available. It was found that pilots fly fighters very differently than was the norm for the period of time when most design criteria specifications were written, largely because the environment created by today's detection systems and weapons is very different than it was then. It was found that as technology advances, such advanced composite construction and fly-by-wire control systems make it possible to tailor the configuration to achieve a maneuvering capability previously unattainable. It is concluded that the method of selecting design cases need to be updated. Available methods for predicting loads for new, more complex design cases are discussed. No firm recommendations can be made, but a number of suggestions are made which, it is hoped, will contribute to fruitful future consideration of the problems discussed. Author

N86-27277# National Aerospace Lab., Tokyo (Japan).
AN ANALYSIS OF THE LIMIT CYCLE OBSERVED IN THE FUNCTIONAL MOCKUP TEST OF THE NAL QSTOL RESEARCH AIRCRAFT
Hiroyuki Yamato, Tadao Uchida, Noriaki Okada, Toshio Ogawa, and Akira Tada Dec. 1985 56 p In JAPANESE; ENGLISH summary
(NAL-TR-893; ISSN-0389-4010) Avail: NTIS HC A04/MF A01

The quiet STOL research aircraft under development at the National Aerospace Laboratory is equipped with the Stability and Control Augmentation System (SCAS). When the SCAS Pitch CWS mode is engaged in flight simulation tests using the control system functional mockup, a small limit cycle is observed. The method of describing functions is used to analyze this problem, because nonlinearities in the mechanical linkages and the power actuator play an important role in sustaining the limit cycle. To construct a mathematical model of the control system, nonlinear elements are employed so that the model response may accord with functional mockup test results including the frequency response. Through both the test and the analysis, it is shown that the present method is an effective tool for analyzing the limit cycle. And it is also clarified that the limit cycle observed is not so annoying to the pilot and is within the limits of the MIL specifications for sustained oscillations. Author

N86-27278*# PRC Kentron, Inc., Hampton, Va.
EFFECT OF EMERGING TECHNOLOGY ON A CONVERTIBLE, BUSINESS/INTERCEPTOR, SUPERSONIC-CRUISE JET
F. L. Beissner, Jr., W. A. Lovell, A. Warner Robins, and E. E. Swanson May 1986 60 p
(Contract NAS1-18000)
(NASA-CR-178097; NAS 1.26:178097) Avail: NTIS HC A04/MF A01 CSCL 01C

This study was initiated to assess the feasibility of an eight-passenger, supersonic-cruise long range business jet aircraft that could be converted into a military missile carrying interceptor. The baseline passenger version has a flight crew of two with cabin space for four rows of two passenger seats plus baggage and lavatory room in the aft cabin. The ramp weight is 61,600 pounds with an internal fuel capacity of 30,904 pounds. Utilizing an improved version of a current technology low-bypass ratio turbofan engine, range is 3,622 nautical miles at Mach 2.0 cruise and standard day operating conditions. Balanced field takeoff distance is 6,600 feet and landing distance is 5,170 feet at 44,737 pounds. The passenger section from aft of the flight crew station to the aft pressure bulkhead in the cabin was modified for the interceptor version. Bomb bay type doors were added and volume is sufficient for four advanced air-to-air missiles mounted on a rotary launcher. Missile volume was based on a Phoenix type missile with a weight of 910 pounds per missile for a total payload weight of 3,640 pounds. Structural and equipment weights were adjusted and result in a ramp weight of 63,246 pounds with a fuel load of 30,938 pounds. Based on a typical intercept mission flight profile, the resulting radius is 1,609 nautical miles at a cruise Mach number of 2.0. Author

N86-27279*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DIVERGENCE STUDY OF A HIGH-ASPECT RATIO, FORWARD-SWEPT WING
Stanley R. Cole Jun. 1986 10 p Presented at the AIAA 24th Aerospace Sciences Meeting, Reno, Nev., 6-9 Jan. 1986 Previously announced in IAA as A86-19632
(NASA-TM-87682; NAS 1.26:87682) Avail: NTIS HC A02/MF A01 CSCL 01C

An experimental wind-tunnel study to determine the divergence characteristics of a high-aspect ratio, forward-swept wing has been conducted in the NASA Langley Research Center (LaRC) Transonic Dynamics Tunnel (TDT). The rectangular wing used for this study had a panel aspect ratio of 9.16 (lambda = 0 deg.) and the sweep angle could be set at lambda = 0 deg., -15 deg., -30 deg., -45 deg., or -60 deg. A rectangular wing tip shape was tested at each of these sweep angles. In addition, a tip shape parallel to the freestream flow was tested for a wing sweep angle of lambda = -45 deg. The root of the wing was cantilever mounted to the wall of the wind tunnel. Divergence conditions were measured at M = 0.4 for each sweep angle and tip configuration tested. Subcritical response techniques were used to extrapolate to the divergence conditions during the wind-tunnel test. The primary objective of this test was to obtain data which could be used to verify for this configuration the divergence prediction capability of an aeroelastic analysis code. Subsonic lifting surface theory (kernel function) aerodynamics are utilized by this particular code. The analytical predictions of divergence were found to be significantly conservative at all forward sweep angles. At lambda = -45 deg., the analysis was 14 percent conservative. The effect of the two tip shapes on the divergence dynamic pressure was predicted accurately by the analysis. The divergence condition for the tip shape parallel to the flow occurred at a dynamic pressure 14 percent higher than the divergence condition with a rectangular tip shape. Author

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N86-27280* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRCRAFT LIFTMETER Patent
Ernest W. Millen, inventor (to NASA) Issued 29 Apr. 1986 10 p Filed 8 Feb. 1984 Supersedes N84-32383 (22 - 22, p 3535) Sponsored by NASA. Langley Research Center

(NASA-Case-LAR-12518-1; US-Patent-4,586,140; US-Patent-Appl-SN-578388; US-Patent-Class-364-433; US-Patent-Class-364-435; US-Patent-Class-244-181; US-Patent-Class-73-178T; US-Patent-Class-340-968) Avail: US Patent and Trademark Office CSCL 01D

A display for aiding the pilot of an aircraft in anomalous wind environments is described. Wind velocity components are measured by an instrument, processed by a computer and a vector generator, and then displayed as a vector. The display utilizes the measurements of ground speed and of wind velocity in three mutually perpendicular directions. This display will also show changes in lift of an aircraft. B.W.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-27281# National Aerospace Lab., Tokyo (Japan).
A STUDY ON CONTROL SYSTEM OF HIGH EFFICIENCY GAS TURBINE AGTJ100(1); CONTROL SYSTEM DEVELOPMENT FACILITIES AND ITS CHARACTERISTICS
Nanahisa Sugiyama, Takeshi Koshinuma, and Kenji Nishio Dec. 1985 48 p In JAPANESE; ENGLISH summary
(NAL-TR-895; ISSN-0389-4010) Avail: NTIS HC A03/MF A01

A national research and development program on High Efficiency Gas Turbines is under way. The target of the program is to develop an intercool/reheat type gas turbine engine for 100 MW class power generation with very high thermal efficiency, resulting in energy conservation. The requirement for engine control is severe due to the complexity of the engine cycle and geometry. Therefore, development of an engine controller, an inherently sophisticated multivariate controller, is considered to be one of the most important items for the success of the program. The basic plan, fabrication, and characteristics of the control system development facilities are described. The facilities consist of a high speed digital simulator (AD10) for real time gas turbine simulation, a peripheral array processor (MAP300) for matrix operation and time series analysis, and a general purpose super minicomputer (VAX11/750). These can be utilized effectively in various stages of development of a control system, such as design, evaluation, and hardware test. Author

N86-27282*# Hamilton Standard, Windsor Locks, Conn.
LARGE-SCALE ADVANCED PROP-FAN (LAP) PITCH CHANGE ACTUATOR AND CONTROL DESIGN REPORT
Robert A. Schwartz, Paul Carvalho, and Mark J. Cutler 31 Jan. 1986 187 p Original document contains color illustrations
(Contract NAS3-23051)
(NASA-CR-174788; NAS 1.26:174788) Avail: NTIS HC A09/MF A01 CSCL 01A

In recent years, considerable attention has been directed toward improving aircraft fuel consumption. Studies have shown that the high inherent efficiency previously demonstrated by low speed turboprop propulsion systems may now be extended to today's higher speed aircraft if advanced high-speed propeller blades having thin airfoils and aerodynamic sweep are utilized. Hamilton Standard has designed a 9-foot diameter single-rotation Large-Scale Advanced Prop-Fan (LAP) which will be tested on a static test stand, in a high speed wind tunnel and on a research aircraft. The major objective of this testing is to establish the structural integrity of large-scale Prop-Fans of advanced construction in addition to the evaluation of aerodynamic performance and aeroacoustic design. This report describes the operation, design features and actual hardware of the (LAP) Prop-Fan pitch control system. The pitch control system which controls blade angle and propeller speed consists of two separate assemblies. The first is the control unit which provides the hydraulic supply, speed governing and feather function for the system. The second unit is the hydro-mechanical pitch change actuator which directly changes blade angle (pitch) as scheduled by the control. Author

N86-27283*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
STRUCTURAL TAILORING OF ENGINE BLADES (STAEBL) THEORETICAL MANUAL
K. W. Brown Mar. 1985 51 p
(Contract NAS3-22525)
(NASA-CR-175112; NAS 1.26:175112; PWA-5774-40) Avail: NTIS HC A04/MF A01 CSCL 21E

This Theoretical Manual includes the theories included in the Structural Tailoring of Engine Blades (STAEBL) computer program which was developed to perform engine fan and compressor blade numerical optimizations. These blade optimizations seek a minimum weight or cost design that satisfies practical blade design constraints, by controlling one to twenty design variables. The STAEBL constraint analyses include blade stresses, vibratory response, flutter, and foreign object damage. Blade design variables include airfoil thickness at several locations, blade chord, and construction variables: hole size for hollow blades, and composite material layup for composite blades. Author

N86-27284*# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
STRUCTURAL TAILORING OF ENGINE BLADES (STAEBL) USER'S MANUAL
K. W. Brown Mar. 1985 106 p
(Contract NAS3-22525)
(NASA-CR-175113; NAS 1.26:175113; PWA-5774-39) Avail: NTIS HC A06/MF A01 CSCL 21E

This User's Manual contains instructions and demonstration case to prepare input data, run, and modify the Structural Tailoring of Engine Blades (STAEBL) computer code. STAEBL was developed to perform engine fan and compressor blade numerical optimizations. This blade optimization seeks a minimum weight or cost design that satisfies realistic blade design constraints, by tuning one to twenty design variables. The STAEBL constraint analyses include blade stresses, vibratory response, flutter, and foreign object damage. Blade design variables include airfoil thickness at several locations, blade chord, and construction variables: hole size for hollow blades, and composite material layup for composite blades. Author

N86-27285*# Massachusetts Inst. of Tech., Cambridge. Gas Turbine and Plasma Dynamics Lab.
CHANNEL FLOW MODELING OF IMPINGEMENT COOLING OF A ROTATING TURBINE BLADE
JaHye Jenny Koo Dec. 1984 94 p
(Grant NAG3-335)
(NASA-CR-177206; NAS 1.26:177206; GTPDL-181) Avail: NTIS HC A05/MF A01 CSCL 21E

Local heat transfer distributions in impingement cooling have been measured by Kreatsoulas and Prieser for a range of conditions which model those in actual turbine blades, including the effects of rotation. These data were reported as local Nusselt numbers, but referred to coolant supply conditions. By means of a channel flow modeling of the flow in the supply and impingement passages, the same data are here presented in terms of local Nusselt number distributions such as are used in design. The results in this form are compared to the nonrotating impingement results of Chupp and to the rotating but nonimpingement results of Morris. Rotation reduces the mean Nusselt numbers from these found by Chupp by about 30 percent, and introduces important radial variations which are sensitive to rotation and to leading edge stagger angle. Author

N86-27286# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
A MICROCOMPUTER BASED SCANNING PRESSURE MEA-

SUREMENT SYSTEM Final Report, Jan. - Aug. 1985
Stephen F. Foley Jan. 1986 48 p
(AD-A165051; AFWAL-TR-85-2075) Avail: NTIS HC A03/MF A01 CSCL 21/5

There is a requirement in the Air Force Wright Aeronautical Laboratory's Compressor Research Facility (CRF) for a multichannel pressure measurement system which can easily integrate into its present data acquisition system. The requirement for this system is based on a need for measurement of a large number of steady state pressures emanating from gas turbine engine compressor test vehicles. Implementation of such a system would greatly expand the data gathering capability of the CRF while vacating presently available channels for use in higher response pressure measurement applications. This report describes in detail the design and implementation of a scanning pressure measurement system which uses a personal computer as the controlling and data processing element. GRA

N86-27287# Naval Academy, Annapolis, Md. Div. of Engineering and Weapons.
NUMERICAL HEAT TRANSFER MODEL FOR A HEAT-BARRIER-PISTON ENGINE WITH HYPERGOLIC COMBUSTION Progress Report, 1982 - 1986
David A. Blank Feb. 1986 193 p
(AD-A165083; USNA-EW-8-86) Avail: NTIS HC A09/MF A01 CSCL 21/7

Axisymmetric turbulent combustion flow with heat transfer has been modeled for a four-stroke engine exhibiting hypergolic combustion and containing a heat barrier within the piston. The boundaries of the solution scheme extend fixed distances into the piston and cylinder lining. In the model, a valve was simulated which has thickness for the purpose of heat transfer calculations and is infinitely thin for the purpose of fluid field calculations. A fuel injector was numerically modeled which gave good simulation of the type of injector used in current hypergolic combustion research. The implicit finite-difference solution of the governing equations for the primitive variables was conducted in three regions, one fixed in space with time, one utilizing a stretching and compressing computational mesh and one which moved with time without stretching and compressing. An accuracy check of the computational code for the five primitive variables representing the non-combustion case was conducted by specifying an analytic expression for each of these variables and changing the source terms of the corresponding governing equations to make these analytic expressions into the solution computed solution with the specified analytic solution for the resultant set of modified equations. Comparis on of the numerically computed solution with the specified analytic solution gave excellent agreement. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N86-27288* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THUMB-ACTUATED TWO-AXIS CONTROLLER Patent
Richard H. Hollow, inventor (to NASA) (Computer Sciences Corp., Mountain View, Calif.) Issued 22 Apr. 1986 11 p Filed 8 Sep. 1982 Supersedes N83-12098 (21 - 03, p 328) Sponsored by NASA. Ames Research Center
(NASA-Case-ARC-11372-1; US-Patent-4,584,510; US-Patent-Appl-SN-415878; US-Patent-Class-318-584; US-Patent-Class-318-640; US-Patent-Class-250-211K; US-Patent-Class-200-157; US-Patent-Class-244-234) Avail: US Patent and Trademark Office CSCL 01C

A two axis joystick controller is described. It produces at least one output signal in relation to pivotal displacement of a member with respect to an intersection of the two axes. The member is pivotally movable on a support with respect to the two axes. The support has a centrally disposed aperture. A light source is mounted on the pivotally movable member above the aperture to direct light through the aperture. A light sensor is mounted below the aperture in the support at the intersection of the two axes to receive the light from the light source directed through the aperture. The light sensor produces at least one output signal related to a location on the sensor at which the light from the light source strikes the sensor. NASA

N86-27289# National Aeronautical Lab., Bangalore (India). Aerodynamics Div.
A COMPUTER PROGRAMME FOR DATCOM METHODS OF ESTIMATION OF LATERAL STABILITY AND CONTROL DERIVATIVES
S. Ramabhadran and H. Sundaramurthy Mar. 1986 46 p
(NAL-TM-AE-8601) Avail: NTIS HC A03/MF A01

A computer code has been developed to estimate the lateral stability and control derivatives of aircraft configuration. The code, in general, is based on USAF DATCOM methods; in the case of a few derivatives, some approximate relations are used. The code estimates nine important lateral derivatives and five control derivatives. A brief review of the methods along with the limitations of DATCOM are presented. A comparison between the results of the code with those of the working examples of DATCOM are given for some cases. Application of the code for typical configurations is discussed. Author

N86-27290*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGHLY MANEUVERABLE AIRCRAFT TECHNOLOGY (HIMAT) FLIGHT-FLUTTER TEST PROGRAM
Michael W. Kehoe May 1984 20 p
(NASA-TM-84907; H-1183; NAS 1.15:84907) Avail: NTIS HC A02/MF A01 CSCL 01C

The highly maneuverable aircraft technology (HiMAT) vehicle was evaluated in a joint NASA and Air Force flight test program. The HiMAT vehicle is a remotely piloted research vehicle. Its design incorporates the use of advanced composite materials in the wings, and canards for aeroelastic tailoring. A flight-flutter test program was conducted to clear a sufficient flight envelope to allow for performance, stability and control, and loads testing. Testing was accomplished with and without flight control-surface dampers. Flutter clearance of the vehicle indicated satisfactory damping and damping trends for the structural modes of the HiMAT vehicle. The data presented include frequency and damping plotted as a function of Mach number. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N86-27291*# Wichita State Univ., Kans. Dept. of Aeronautical Engineering.
DE-ICING OF THE ALTITUDE WIND TUNNEL TURNING VANES BY ELECTRO-MAGNETIC IMPULSE Final Report
Glen W. Zumwalt and Richard Ross Mar. 1986 79 p
(Grant NAG3-607)
(NASA-CR-177260; NAS 1.26:177260) Avail: NTIS HC A05/MF A01 CSCL 14B

The Altitude Wind Tunnel at the NASA-Lewis facility is being proposed for a refurbishment and moderization. Two major changes are: (1) the increasing of the test section Mach number to 0.90, and (2) the addition of spray nozzles to provide simulation of flight in icing clouds. Features to be retained are the simulation of atmospheric temperature and pressure to 50,000 foot altitude and provision for full-scale aircraft engine operation by the

exhausting of the aircraft combustion gases and ingestion of air to replace that used in combustion. The first change required a re-design of the turning vanes in the two corners downstream of the test section due to the higher Mach number at the corners. The second change threatens the operation of the turning vanes by the expected ice build-up, particulary on the first-corner vanes. De-icing by heat has two drawbacks: (1) an extremely large amount of heat is required, and (2) the melted ice would tend to collect as ice on some other surfaces in the tunnel, namely, the tunnel propellers and the cooling coils. An alternate de-icing method had been under development for three years under NASA-Lewis grants to the Wichita State University. This report describes the electro-impulse de-icing (EIDI) method and the testing work done to assess its applicability to wind tunnel turning vane de-icing. Tests were conducted in the structural dynamics laboratory and in the NASA Icing Research Tunnel. Good ice protection was achieved at lower power consumption and at a wide range of tunnel operations conditions. Recommendations for design and construction of the system for this application of the EIDI method are given. Author

N86-27292*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.

PERFORMANCE TESTS FOR THE NASA AMES RESEARCH CENTER 20 cm X 40 cm OSCILLATING FLOW WIND TUNNEL Progress Report, 1 Jun. - 31 Dec. 1984

William J. Cook and Tim A. Giddings 31 Dec. 1984 46 p (Grant NCC2-200)

(NASA-CR-176385; NAS 1.26:176385; ISU-ERI-Ames-85436) Avail: NTIS HC A03/MF A01 CSCL 14B

An evaluation is presented of initial tests conducted to assess the performance of the NASA Ames 20 cm x 40 cm oscillating flow wind tunnel. The features of the tunnel are described and two aspects of tunnel operation are discussed. The first is an assessment of the steady mainstream and boundary layer flows and the second deals with oscillating mainstream and boundary layer flows. Experimental results indicate that in steady flow the test section mainstream velocity is uniform in the flow direction and in cross section. The freestream turbulence intensity is about 0.2 percent. With minor exceptions the steady turbulent boundary layer generated on the top wall of the test section exhibits the characteristics of a zero pressure gradient turbulent boundary layer generated on a flat plate. The tunnel was designed to generate sinusoidal oscillating mainstream flows. Experiments confirm that the tunnel produces sinusoidal mainstream velocity variations for the range of frequencies (up to 15 Hz). The results of this study demonstrate that the tunnel essentially produces the flows that it was designed to produce. Author

N86-27293# Washington Univ., Seattle. Transportation Center.

USE OF NDE TO EVALUATE REFLECTION CRACKING IN AIRFIELD PAVEMENTS Final Report, Feb. - Aug. 1984

David E. Newcomb, Joe P. Mahoney, and Jatinder Sharma Nov. 1985 129 p

(Contract F08635-84-K-0145)

(AD-A164880; AFESC/ESL-TR-84-42) Avail: NTIS HC A07/MF A01 CSCL 14/2

This study reports on the possible use of nondestructive testing equipment to evaluate the potential of reflection cracking in airfield pavements. It also summarizes the state of the art of reflection cracking analysis and methods for controlling reflection cracking. The proposed method of analysis consists of testing portland cement concrete slabs in a curled-up condition at slab centers and slab corners. Increased tensile strains at the bottom of the overlays at slab corners are related to the number of traffic repetitions to predict reflection cracking life. Although the method appears promising, further study is recommended to extend the limited data base presented here and gain added insight into the nature of mechanisms which cause reflection cracking. GRA

N86-27294# Illinois Univ., Urbana. Civil Engineering Lab.

CONCEPTS FOR THE DEVELOPMENT OF A NONDESTRUCTIVE TESTING AND EVALUATION SYSTEM FOR RIGID AIRFIELD PAVEMENTS Final Report, Jan. 1983 - May 1985

P. T. Foxworthy Nov. 1985 274 p Previously announced as N86-15324

(Contract F08637-84-M-1743)

(AD-A165055; AFESC/ESL-TR-85-46) Avail: NTIS HC A12/MF A01 CSCL 14/2

This technical report develops a complete system for nondestructive testing and evaluation of rigid airfield pavements. An extensvie review of present destructive and nondestructive equipment and methodologies is made to form the basis for selection of the equipment and analytical model used in this research. A brief description of the selected Dynatest Model 8000 Falling Weight Deflectometer (FWD) and the ILLISLAB finite element computer model is presented. Three Air Force installations were chosen for in-depth study of pavement response to FWD loads under a variety of environmental and geological conditions. Techniques are presented to determine the location of maximum damage to rigid pavement slabs for one or any combination of aircraft, and the validity of the calculated stresses is established through comparisons of measured and predicted deflections at joints. Major study findings include: (1) new designations for pavement features based on actual loading conditions, (2) guidelines for planning and conducting large-scale evaluations of major airfield systems, (3) a computer-based determination of E and K, (4) joint behavior prediction under fluctuating temperatures and their effect on generated slab stresses, (5) procedures to account for the annual distribution of traffic over the range of temperatures normally experienced at any facility, and (6) a simplistic means of estimating total past damage from aircraft operations. Author (GRA)

N86-27295# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.

VERIFICATION AND AERODYNAMIC CALIBRATION OF THE TUNNEL 16T CAPTIVE TRAJECTORY SUPPORT (CTS) SYSTEM Final Report, 21 Jul. - 26 Jul. 1985

E. G. Allee, Jr. and M. L. Mills Mar. 1986 60 p Prepared in cooperation with Calspan Field Services, Inc., Arnold AFS, Tenn. (AD-A165235; AEDC-TR-86-4) Avail: NTIS HC A04/MF A01 CSCL 14/2

An air-on demonstration of the Captive Trajectory Support (CTS) system was conducted in the Propulsion Wind Tunnel (16T) on July 21 through July 26, 1985. The test objectives were; (1) to demonstrate the structural integrity of the CTS system; (2) to demonstrate the ability of the CTS system to satisfactorily obtain grid and trajectory generation data for a typical shore model in free stream and relative to a simulated (flat plate) aircraft in a dynamic wind tunnel environment; and (3) to obtain a Mach number calibration for the Tunnel 16T Cart 2 (Multi-Purpose Cart) with the CTS system installed. The 1/4-scale Maximum Volume Bomb (MVB) was used to represent a typical store. Data were obtained at free-stream Mach numbers from 0.3 to 1.6 at stagnation pressures from 400 to 1600 psfa. GRA

N86-27296# Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (West Germany). Unternehmensbereich UT.

DEVELOPMENT, CONSTRUCTION, AND MANUFACTURING OF WIND TUNNEL MODELS FOR AERODYNAMIC INVESTIGATIONS Final Report, Mar. 1984

Karl Kaszemeik Bonn (West Germany) Bundesministerium fuer Forschung und Technologie Nov. 1985 50 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-85-012; ISSN-0170-1339; ESA-86-96887; TE-2-1363) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 11

Models and model components for aerodynamic research in the European airbus project A-320 were manufactured with a numerical control milling machine and prepared for testing: Three high speed wings IFAS 5, 6, and 6.1; a low speed halfmodel with IFAS 6; a low speed complete model with IFAS 6; a halfmodel as test setup for high and low speed; an A-310 research model for the active tail-section design; and a propulsion simulator were produced. ESA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N86-27297*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1985 GET AWAY SPECIAL EXPERIMENTER'S SYMPOSIUM
Lawrence R. Thomas, ed. and Frances L. Mosier, ed. May 1986 295 p Symposium held in Greenbelt, Md., 8-9 Oct. 1985 (NASA-CP-2401; Rept-86B0015; NAS 1.55:2401) Avail: NTIS HC A13/MF A01 CSCL 22A

The 1985 Get Away Special (GAS) Experimenter's Symposium provided a formal opportunity for GAS experimenters to share the results of their projects. The focus is on payloads that have been flown on Shuttle missions, and on GAS payloads that will be flown in the near future. For individual titles, see N86-27298 through N86-27329.

N86-27298*# Medical Univ. of South Carolina, Charleston. Dept. of Family Medicine.
TO CATCH A COMET: TECHNICAL OVERVIEW OF CAN DO G-324
Thomas J. OBrien, ed. *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 1-9 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The primary objective of the C. E. Williams Middle School Get Away Special CAN DO is the photographing of Comet Halley. The project will involve middle school students, grades 6 through 8, in the study and interpretation of astronomical photographs and techniques. G-324 is contained in a 5 cubic foot GAS Canister with an opening door and pyrex window for photography. It will be pressurized with one atmosphere of dry nitrogen. Three 35mm still cameras with 250 exposure film backs and different focal length lenses will be fired by a combination of automatic timer and an active comet detector. A lightweight 35mm movie camera will shoot single exposures at about 1/2 minute intervals to give an overlapping skymap of the mission. The fifth camera is a solid state television camera specially constructed for detection of the comet by microprocessor. Author

N86-27299*# Medical Univ. of South Carolina, Charleston. Pathology Image Analysis Lab.
TO CATCH A CHILDS'S IMAGINATION: EDUCATIONAL OVERVIEW OF CAN DO G-324
James H. Nicholson *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 11-17 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The experience has shown that a GAS experiment can be a valuable education tool. It can return results far in excess of the resources invested. The best estimate on the financial investment per student indicates that it is somewhat less than the cost of a school lunch. That's a bargain in a time when educational bargains are hard to come by. To reach this goal means reaching far beyond the students who could possibly design or fly experiments in a single canister. The greatest value of CAN DO is that it serves as a catalyst and inspiration for other activities. To not reach out would have turned it into an overblown, expensive science fair project for a few exceptional students. To fully exploit the benefit of a GAS canister, you should build on a well established science enrichment program. As part of a comprehensive plan, a GAS can be one of the most motivating educational tools available. Author

N86-27300*# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Eng.
SPACE MANUFACTURING UTILIZING THE DIRECTIONAL ELECTROSTATIC ACCRETION PROCESS
Alan Mortensen *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 19-24 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The Directional Electrostatic Accretion Process (DEAP) is described with respect to both the physical process and its application to manufacturing in space. This high precision portable manufacturing method will revolutionize current practices in manufacturing and repair of spacecraft and space structures. The cost effectiveness of this process will be invaluable to future space manufacturing projects. Author

N86-27301*# Computer Sciences Corp., El Segundo, Calif.
THE NORTHERN UTAH SATELLITE (NUSAT) COMMUNICATIONS LINK c32
Lee Barrett *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 25-32 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

During the planning stages of the NUSAT satellite, an obvious issue to be discussed was the method of communications to be used. The frequencies would have to be high enough to pass through the atmosphere relatively unattenuated but low enough that antennas and transmission lines would not be so critical in length and properties that unexperienced students would have difficulty with handling them. The frequencies of 450.000 MHz and 137.900 MHz were decided upon and applied for licensing. Representatives of the amateur radio satellite organization, AMSAT, were contacted for ideas. This organization seems to favor AM types of emissions such as CW to control their OSCAR series of satellites and also the current Phase 3 unit. NUSAT personnel felt, however, that there would be merit in the improved signal to noise ratio usually obtained in an FM mode. Doppler shift of the transmitted information on the NUSAT also had to be considered. The final decision was to use Audio Frequency Shift Keying (ASKF) modulated on an FM carrier. In this mode audio tones used would not shift frequency with Doppler. Author

N86-27302*# Worcester Polytechnic Inst., Mass.
FLUID BEHAVIOR IN MICROGRAVITY c34
William W. Durgin and James W. Matthews *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 33-40 refs (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

An experiment designed to study some fundamental aspects of microgravity fluid dynamics has been built and is scheduled for flight. The purpose of the experiment is to investigate differences in behavior of wetting and nonwetting fluid systems at low Bond numbers. Methods were developed to determine liquid quantity, estimate vapor contact area and measure liquid layer thickness. Both the responses of the fluid systems to external perturbations and the transfer of liquid through a connection between two containers can be studied. Author

N86-27303*# National Electric Co. of Venezuela, Caracas.
THE CASTING OF SEMI-PERMEABLE MEMBRANES IN A MICROGRAVITY ENVIRONMENT
Ivan Vera *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 41-44 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The experiment is to study polymeric membranes. Presently, semipermeable membranes are being manufactured from several different kinds of polymers all over the world and specific applications have been identified in fluid separation processes such as reverse osmosis, ultrafiltration and electrodialysis. Although, the ultrastructure of asymmetric and composite membranes have been under intensive study, still there are many questions about the factors affecting this structure and their degree of correlation. Nevertheless, there is indication that the entire morphological structure of polymeric membranes could be affected by the difference in specific gravity between the cast solution and the coagulation liquid normally used in the membranes preparation process. The casting of semipermeable membranes in space might

help to identify the effect of gravity upon the structure of these membranes. It is important to recognize that the casting process involves changes of state and that in a microgravity environment, there will be a reduction on buoyancy-driven natural convection and density gradients. Author

N86-27304*# Colorado Univ., Boulder.
CU IN SPACE: THE UNIVERSITY OF COLORADO GET AWAY SPECIAL PAYLOAD G-285
Kent Tobiska *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 49-56 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

There are four separate experiments integrated into the single payload of G-285 which are supported by internal payload power, thermal environment control, command and data handling facilities and structural subsystems. The four experiments contained in this payload are: a single spectrometer performing two experiments - one to study night time shuttle glow phenomena in the ultraviolet and the other to observe NO2 concentrations over equatorial latitudes in the day; a fluids management experiment using centrifugation for particle/liquid/vapor separation; and an experiment using Phycomyces fungi to study the gravireceptor mechanism theory. The experiments are supported by a microprocessor, data storage devices, power and thermal control subsystems. Author

N86-27305*# Purdue Univ., West Lafayette, Ind.
DESIGN OF AN EXPERIMENT FOR THE PRODUCTION OF A FOAMED TIN SAMPLE c26
Eric Wernimont *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 57-63 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

One of the major experiments in the GAS container is concerned with the experimental production of a foamed metal. A foamed metal is one that contains a significant amount of gas bubbles suspended in its solid volume. Purdue's GAS team proposes to do this with the help of a solid zinc carbonate that gives off carbon dioxide at high temperatures. Because of low energy requirements, the metal used for this experiment is tin. It is hoped that the use of near zero environment will keep the suspended bubbles more uniform than in an Earth based process, hence not depleting the physical strength of the material as greatly as is observed on Earth. Author

N86-27306*# San Jose State Univ., Calif. Space Research and Development Organization.
THE DEVELOPMENT OF A PROJECT PLAN FOR THE GET AWAY SPECIAL PROGRAM
Steven J. Butow *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 65-72 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

Trying to get a project started? Well, since the introduction of the Get Away Special Program, there have been 451 reservations placed by people who, just like yourself, are eager to send a small payload into space; and yet only 33 of them have actually succeeded. Even more staggering, many of those who have flown have done so more than once; meaning that less than 10% of all GAS users have actually sent something into space. Some of the problems that face GAS users are approached and it is hoped that they will be helpful, especially to those new to the program. Some of the subject areas include selecting a project, and payload management. Author

N86-27307*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROJECT EXPLORER GAS #007: MARSHALL AMATEUR RADIO CLUB EXPERIMENT (MARCE)
Edward F. Stluka *In its* The 1985 Get Away Special Experimenter's Symposium May 1986 p 73-80 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

Polls were taken at the Project Explorer meetings regarding flying without the radio experiment transmitting. The radio downlinks require extra coordination and are sensitive to certain payloads. The poll results were unanimous. The radio downlinks are vital in providing data on the health and status of the total experiments package, in real time, during the flight. The amateur radio operators, prepared to receive the downlinks and OSCAR-10 relays, revealed that there was enormous interest throughout the world, to participate. This sets the stage for the reflight opportunities which the GAS program has provided. Major activities, pertinent to the STS-41G flight preparations by the GAS #007 team and support group, are listed. Author

N86-27308*# Asahi National Broadcasting Co., Tokyo (Japan).
WATER BALL COLLISION c34
Kazuo Fujimoto *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 81-84 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

What happens if a stainless steel ball hits a water ball in the weightless space ot the Universe? In other words, it was the objective of our experiments in the Space to observe the surface tension of liquid by means of making a solid collide with a liquid. Place a small volume of water between 2 glass sheets to make a thin water membrane: the 2 glass sheets cannot be separated unless an enormous force is applied. It is obvious from this phenomenom that the surface tension of water is far greater than presumed. On Earth, however, it is impossible in most cases to observe only the surface tension of liquid, because gravity always acts on the surface tension. Water and stainless steel balls were chosen the liquid and solids for the experiments. Because water is the liquid most familiar to us, its properties are well known. And it is also of great interest to compare its properties on the Earth with those in the weightless space. Author

N86-27309*# Air Force Academy, Colo. Dept. of Engineering Mechanics.
UNITED STATES AIR FORCE ACADEMY'S MICRO-GRAVITY RESEARCH USING G-0307
Glon D. Turner *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 85-86 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The current materials research being done in microgravity solidification and the future experimentation planned onboard a space shuttle mission is reported. The Department of Engineering Mechanics at the USAF Academy is developing a microgravity furnace to be used on board the space shuttle. The microgravity furnace will be used to conduct materials research dealing with such topics as immiscible alloy solidification. The purpose behind this research project is three-fold: to develop a simple, inexpensive, and easy to use furnace to conduct space materials research, to conduct a solidification experiment on a lead-zinc alloy in space that macrosegregates due to gravity, and to provide a research mechanism for students to get involved with space materials research. Author

N86-27310*# Federal Aviation Administration, Salt Lake City, Utah.
NUSAT 1: THE FIRST EJECTABLE GETAWAY SPECIAL
Charles A. Bonsall and R. Gilbert Moore (Morton Thiokol, Brigham City, Utah) *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 87-99 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

Four hours, fourteen minutes and forty-two seconds after the space shuttle, Challenger, was launched on mission 51B, a small satellite was ejected into independent orbit from a Getaway Special canister. This event was an exciting milestone in a project conceived over seven years ago. It is hoped that the story of NUSAT (Northern Utah SATellite) will be an inspiration for other experimentors to exploit this new service of the Getaway Special program. The purpose and history of the project, the NUSAT

spacecraft, the ground station and its operation, and some future directions envisioned by the participants are described. Author

N86-27311*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
MATERIAL SCIENCES EXPERIMENTS UNDER MICROGRAVITY CONDITIONS WITH MAUS
G. H. Otto and D. Baum *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 101-108 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

Project MAUS is a part of the German material sciences program and provides autonomous payloads for the Space Shuttle. These payloads are housed in canisters which are identical with those of NASA's Get Away Special program. The main components of the hardware are: a standard system consisting of power supply, experiment control, data acquisition and the experiment modules containing experiment specific hardware. So far, three MAUS modules with experiments from the area of material sciences have been flown as GAS payloads. They deal with the effects of reduced sedimentation, convection phenomena caused by temperature gradients and the behavior of dispersed particles ahead of a solid/liquid interface. Author

N86-27312*# Worcester Polytechnic Inst., Mass. Dept. of Electrical Engineering.
THE DESIGN OF FLIGHT HARDWARE: ORGANIZATIONAL AND TECHNICAL IDEAS FROM THE MITRE/WPI SHUTTLE PROGRAM
F. J. Looft *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 109-116 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The Mitre Corporation of Bedford Mass. and the Worcester Polytechnic Institute are developing several experiments for a future Shuttle flight. Several design practices for the development of the electrical equipment for the flight hardware have been standardized. Some of the ideas are presented, not as hard and fast rules but rather in the interest of stimulating discussions for sharing such ideas. Author

N86-27313*# Purdue Univ., West Lafayette, Ind. Getaway Special Group.
DESIGN CONSIDERATIONS FOR A GAS MICROCONTROLLER c35
Douglas A. Ritter *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 117-124 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

Some of the design problems that are now being addressed in consideration of a microcontroller for the upcoming GAS payload are discussed. Microcontrollers will be used to run the experiments and to collect and store the data from those experiments. Some of the requirements for a microcontroller are to be small, lightweight, have low power consumption, and high reliability. Some of the solutions that were developed to meet these design requirements are discussed. At present, the experiment is still in the design stage and the final design may change from what is presented here. The search for new integrated circuits which will do all that is needed all in one package continues. Author

N86-27314*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROJECT EXPLORER'S UNIQUE EXPERIMENTS: GET AWAY SPECIAL #007
Arthur J. Henderson, Jr. *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 125-131 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The Project Explorer payload represents the first attempt at broadcasting digitized voice signals via a Space Shuttle flight on amateur radio frequencies. These amateur ham-radio frequencies will be transmitting real time data while the experiments are operating. Experiments 1, 2, and 3 represent the work of students ranging from materials processing to the science of biology. Experiment 1 will study the solidification of two hypereutectic alloys, lead-antimony and aluminum-copper. Experiment 2 will investigate the examination and growth of radish seeds in space. Experiment 3 will examine the electrochemical growth process of potassium tetrocyonoplatinate hydrate crystals and Experiment 4 involves amateur radio transmissions, monitoring and support of the entire Get Away Special (GAS) 007 payload. Author

N86-27315*# Worcester Polytechnic Inst., Mass. Chemical Engineering Dept.
GROWTH OF ZEOLITE CRYSTALS IN THE MICROGRAVITY ENVIRONMENT OF SPACE
A. Sacco, Jr., L. B. Sand, D. Collette, K. Dieselman, J. Crowley, and A. Feitelberg *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 133-140 Sponsored in part by the Mitre Corp. (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

Zeolites are hydrated, crystalline aluminosilicates with alkali and alkaling earth metals substituted into cation vacancies. Typically zeolite crystals are 3 to 8 microns. Larger cyrstals are desirable. Large zeolite crystals were produced (100 to 200 microns); however, they have taken restrictively long times to grow. It was proposed if the rate of nucleation or in some other way the number of nuclei can be lowered, fewer, larger crystals will be formed. The microgravity environment of space may provide an ideal condition to achieve rapid growth of large zeolite crystals. The objective of the project is to establish if large zeolite crystals can be formed rapidly in space. B.G.

N86-27316*# Kayser Threde G.m.b.H., Munich (West Germany).
HALOGEN LAMP EXPERIMENT, HALEX c35
Gunter Schmitt and Jurgen Stapelmann (Dornier-Werke G.m.b.H., Friedrichshafen, West Germany) *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 141-149 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The main purpose of the Halogen Lamp Experiment (HALEX) was to investigate the operation of a halogen lamp during an extended period in a microgravity environment and to prove its behavior in space. The Mirror Heating Facilities for Crystal Growth and Material Science Experiments in space relies on one or two halogen lamps as a furnace to melt the specimens. The HALEX aim is to verify: full power operation of a halogen lamp for a period of about 60 hours; achievement of about 10% of its terrestrial life span; and operation of the halogen lamp under conditions similar to furnace operation. B.G.

N86-27317*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESPONSE OF GAS PAYLOAD (G345 AND G347) TEMPERATURES TO VARIOUS ORBITER FLIGHT ATTITUDES
Werner M. Neupert *In its* The 1985 Get Away Special Experimenter's Symposium May 1986 p 151-164 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

At the beginning of the Get-Away Special (GAS) flight program, the GAS Project flew a Flight Verification Payload on STS-3 to make measurements of the vibrations, acoustic and magnetic environments of the canister, and to obtain thermal profiles of internal and external components of the GAS system. Two types of GAS canister end caps (insulated end cap and silverized teflon covered end cap) were used on the two flights (STS-7 and STS-8) so that a direct comparison of the thermal performance was obtained. These observations were compared with a simple thermal model of the instrument in the GAS canister in order to assess whether such simple models can be useful to experimenters in predicting the thermal response of their payloads. B.G.

N86-27318*# Messerschmitt-Boelkow-Blohm/Entwicklungspring Nord, Bremen (West Germany).
GAS PAYLOAD NO. G-025: STUDY OF LIQUID SLOSHING BEHAVIOUR IN MICROGRAVITY **c34**
C. R. Gilbert *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 165-176 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The Get Away Special (GAS) G-025, which flew on shuttle Mission 51-G, examined the behavior of a liquid in a tank under microgravity conditions. The experiment is representative of phenomena occurring in satellite tanks with liquid propellants. A reference fluid in a hemispherical model tank will be subjected to linear acceleration inputs of known levels and frequencies, and the dynamic response of the tank liquid system was recorded. Preliminary analysis of the flight data indicates that the experiment functioned perfectly. The results will validate and refine mathematical models describing the dynamic characteristics of tank-fluid systems. This will in turn support the development of future spacecraft tanks, in particular the design of propellant management devices for surface tension tanks. Author

N86-27319*# North Carolina Agricultural and Technical State Univ., Greensboro. Student Space Shuttle Program.
MEASUREMENT OF THE HEAT PRODUCED INTERNALLY DURING DISCHARGE BY THE 6V EVEREADY ENERGIZER BATTERY, NO. 528 **c44**
F. D. Hooker, K. R. Brooks, B. K. Burnette, J. D. Hampton, F. W. Crigler, and S. T. Ahrens *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 177-184 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

When a 6V Eveready Energizer Battery, 528, is discharged, heat is produced internally within the battery itself. Detailed measurements of this battery heat were made for a five day discharge period using a load resistance of 20 ohms and an ambient temperature of 10 C. The battery heat produced per quarter day varied considerably, ranging from 1.08 watt-hrs to 2.63 watt-hrs. The total battery heat produced, using a 3.0 volt cutoff, is significant (37 watt-hrs) when compared to the total load heat produced (70 watt-hrs). Author

N86-27320*# Thermo-Systems, Inc., Minneapolis, Minn.
GAS EJECTION SYSTEM OVERVIEW AND DESIGN ENHANCEMENTS **c18**
Pat Miller *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 185-190 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The structural design of the Get Away Special (GAS) ejection system is described. Equipment specifications and modifications are illustrated. Future goals are listed. Author

N86-27321*# Swedish Space Corp., Stockholm.
AN ADVANCED MATERIAL SCIENCE PAYLOAD FOR GAS **c23**
R. Joensson, S. Wallin, and K. Loeth *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 191-217 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The aim of the experiment is to study solidification of different compositions of lead-tin. The weight of the material is quite high: 8 kilograms. Nearly 10% of the payload is sample weight. The dendritic growth and the effect of the absence of natural convection are of particular interest. The results from the flight processed samples will be compared with results from Earth processed samples in order to investigate the influence of the natural convection on the solidification process. The power systems, heat storage and rejection, and mechanical support are discussed in relationship to the scientific requirements. B.G.

N86-27322*# Utah State Univ., Logan. Center for Atmospheric and Space Sciences.
AN UPDATE OF UTAH STATE UNIVERSITY'S GAS ACTIVITIES
L. R. Megill *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 219-230 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The highlights of the Utah State University's participation in the space program are listed. Proposed experiments include: a study of the velocity of a bubble in water under the influence of a temperature gradient; reflight of an experiment on surface tension driven convective flow; surface waves in zero-G; crystallization in zero-G (vapor phase and liquid phase); bio gas generation; and penicillum growth; study of undamped oscillations in a vacuum and zero-G. The effect that spinoffs have had on the Utah State University were discussed. B.G.

N86-27323*# Thermo-Systems, Inc., Minneapolis, Minn.
STRUCTURAL INTEGRITY OF GAS EJECTION SYSTEM **c18**
Mark Cascia *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 231-236 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The following Get Away Special (GAS) ejection system components were analyzed: full diameter motorized door assembly (FDMDA); actuating assembly; gas ejection system; lower end plate; and the battery boxes. Special considerations and experiment constraints are also discussed. B.G.

N86-27324*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CAPILLARY PUMPED LOOP (CPL) GAS EXPERIMENT G-471 **c34**
Dan Butler *In its* The 1985 Get Away Special Experimenter's Symposium May 1986 p 237-253 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The Capillary Pumped Loop (CPL) experiment, G-471 is a thermal control system with high density heat acquisition and transport capability. The CPL consists of two capillary pumped evaporators with integral heaters, a fluid loop charged with ammonia (NH3), a condenser plate (heat sink), and various control electronics. The purpose of the experiment is to demonstrate the capability of a capillary pumped system under zero gravity conditions for use in the thermal control of large scientific instruments, advanced orbiting spacecraft, and space station components. Author

N86-27325*# Messerschmitt-Boelkow-Blohm/Entwicklungspring Nord, Bremen (West Germany).
LESSONS LEARNT FROM 11 GAS PAYLOADS FLOWN ON 5 SHUTTLE MISSIONS
H. Stolze and P. Vits *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 255-265 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

Selected hints derived from 5 years experience in experiment hardware design, hardware qualification, safety provisions, experiment testing, payload integration, flight preparation, battery transport, and postmission checkout are presented. B.G.

N86-27326*# Marshall-McShane, Prescott, Ariz.
G-38, G-39 AND G-40: ART IN SPACE, A DIVERGENT EXPLORATION
Joseph W. McShane *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 267-273 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The results of the Get Away Special (GAS) Arts-Science payload G-38, processed in orbit on board the Space Shuttle Challenger during mission 41-G STS 17, October 5 to 13, 1984 are explained. The payload G-38 was created as a unified Arts-Science payload that simultaneously explored the process of

vapor deposition in the vacuum and weightlessness of the shuttle environment and created a series of space sculptures utilizing this process. The purpose of the experiment was to test the sputter deposition process in space and to create five subtle spherical sculptures with metallic coatings of gold, silver, platinum and chrome. B.G.

N86-27327*# Bristol Aerospace, Ltd., Winnipeg (Manitoba).
DESIGN AND DEVELOPMENT OF A WINDOW ASSEMBLY FOR A GAS PAYLOAD
Bev Christie and Bob Tough *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 275-284 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

A sealed window assembly for the Get Away Special (GAS) payloads was developed from a synthetic fused silica. The details of the design and development of this window assembley are given. Author

N86-27328*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GLOMR SATELLITE PAYLOAD G-308 **c18**
In its The 1985 Get Away Special Experimenter's Symposium May 1986 p 285-291 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

The Global Low Orbiting Message Relay (GLOMR) Satellite and its participation in the pioneering development of a Get Away Special (GAS) satellite launch capability is described. The GLOMR is a data relay communication satellite. Experiment objectives are to demonstrate the store-forward relay of data/messages and the communication to ground user equipment. The 150 pound brass satellite, powered by lead acid batteries and solar cells, includes processing, control and radio frequency electronics for data message handling and storage. The GLOMR is mounted through a Marman clamp ejection/retention pedestal to a five cubic foot GAS canister bottom plate. The GAS canister includes a Full Diameter Motorized Door Assembly lid which is opened remotely by astronauts for satellite launch. Author

N86-27329*# Utah State Univ., Logan. Center for Atmospheric and Space Science.
THERMOCAPILLARY FLOW AND GASEOUS CONVECTION IN MICROGRAVITY: RESULTS FROM GAS PAYLOAD G-0518 **c34**
Scott Thomas *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 293-301 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

Thermocapillary flow and gaseous convection in microgravity were investigated in GAS payload G-0518 during Space Shuttle Mission 41-D. A cylinder of paraffin was supported and heated differentially from its ends to induce a melt from solid to liquid and drive thermocapillary flow in the resulting liquid phase. Laminar thermocapillary flow was observed in the liquid paraffin and found to show a transition to time-dependent oscillatory motion at a Marangoni number of about Ma = 34000 with a period of approximately T = 8 seconds. In addition, free convection in a gas in microgravity was observed for the first time. The gaseous convection was caused by the thermal and/or velocity boundary layers present at the heater-liquid interface. Oscillation occurred in the gaseous convection simultaneously with those in the liquid, implying the two are strongly coupled. The gaseous convection may be driven by coupled thermocapillary flow/thermal expansion convection or microgravity bouyancy convection. Author

N86-27330# European Space Agency, Paris (France).
FUTURE MISSIONS IN SOLAR, HELIOSPHERIC AND SPACE PLASMA PHYSICS
Erica Rolfe and Bruce Battrick Jun. 1985 266 p Conference held in Garmisch-Partenkirschen, West Germany, 30 Apr. - 3 May 1985
(ESA-SP-235; ISSN-0379-6566; ESA-85-95665) Avail: NTIS HC A12/MF A01

The origin of the solar wind, solar-planetary plasma interaction, and small scale plasma structures are some areas of discussion. Other areas are the internal structure of the Sun, the solar and heliospheric observatory, and cluster (space plasma physics. All are projects of ESA. For individual titles, see N86-27331 through N86-27348.

N86-27331# Tromsoe Univ. (Norway). Auroral Observatory.
SOLAR WIND AND CORONAL HOLES **c92**
Egil Leer and Thomas E. Holzer (National Center for Atmospheric Research, Boulder, Colo.) *In* ESA Future Missions in Solar Heliospheric and Space Plasma Physics Jun. 1985 p 3-9 Sponsored by NSF (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

The genesis of high speed solar wind streams, causing recurrent geomagnetic storms, in coronal holes, i.e., low density, low temperature regions in the corona, where the large scale magnetic field opens up into interplanetary space is reviewed. The basic physics of the solar wind emanating from coronal holes are discussed. It is shown that thermally driven solar wind models cannot explain the high flow speeds. The effect of MHD waves on the solar wind and wind from late-type giants and supergiants is also discussed. Author (ESA)

N86-27332# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
ENERGY INPUT INTO THE SOLAR WIND **c92**
E. Marsch *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 11-21 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

The energy input into the solar wind is discussed in terms of observation and fluid theory. Solar wind microphysics and transport are reviewed. In situ observations beyond 0.3 AU and the consequent constraints on solar wind expansion and energetics are treated. Energy and mass flux obtained by indirect means and remote optical sensing of the corona are considered. The need to revise the classical Coulomb collision model of transport is emphasized. Slow and fast mode wave damping, and nonlinear processes leading to damping of Alfven waves, used to explain ion heating in the corona and solar wind, are assessed.
Author (ESA)

N86-27333# National Center for Atmospheric Research, Boulder, Colo. High Altitude Observatory.
THE CORONA AND INTERPLANETARY MEDIUM DURING THE SOLAR CYCLE **c92**
D. G. Sime *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 23-36 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

Long term variations of the solar corona, including observations of the morphology, the brightness, and the rotation characteristics are described. Cyclic changes in the electron corona are interpreted as reflecting changes in the large scale magnetic field over the cycle. The ability to link the coronal magnetic structure and the organization of solar wind speed is extended to develop expectations about the variation of properties of the interplanetary medium (IPM) with the solar cycle. The gross features of the velocity structure are present, and the IPM appears to rotate with a character similar to that of the corona. However, the relationship of the magnetic field in interplanetary space to that in the corona is obscure. The short time scale phenomena which comprise the active component of the corona and interplanetary medium only vary in as much as the global organization of the coronal and interplanetary field varies, so rather than showing a variation in properties as individuals, the active features of the corona and IPM change only in their distribution. Author (ESA)

N86-27334# Bern Univ. (Switzerland). Inst. fuer Physik.
DIAGNOSTICS OF CORONA BY IN-SITU COMPOSITION MEASUREMENTS AT 1 AU **c92**

J. Geiss *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 37-50 Sponsored by Swiss National Science Foundation (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

Measurements of abundances of elements and isotopes in the solar wind and their charge state distributions were used to study the corona and chromosphere. The composition and time variations of the solar wind indicate that two mechanisms are responsible for the observed differences between solar wind abundances and the composition in the outer convective zone of the Sun. The first mechanism is an atom-ion separation process, leading to an overabundance of elements with low first ionization potential in corona and solar wind. The second mechanism operates in the corona. Ions that are not well coupled to the protons and electrons by collisions or waves are not sufficiently accelerated to enter the solar wind with their full abundance. The anomalous abundances in the driver gas that follows flare driven interplanetary shocks imply that the corona (before perturbation) is compositionally stratified. Author (ESA)

N86-27335# Dartmouth Coll., Hanover, N.H.
SOLAR WIND INTERACTION WITH PLANETARY MAGNETIC FIELDS **c92**
B. U. O. Sonnerup *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 53-64 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

The interaction between the solar wind and a strongly magnetized planet is reviewed. Processes which lead to the transport of flux, mass, momentum and energy from the solar wind across the magnetopause into the planetary magnetosphere are discussed. Magnetospheric geometry, flow without reconnection, and reconnection at the magnetopause are considered. Author (ESA)

N86-27336# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
SOLAR WIND INTERACTION WITH NEUTRAL ATMOSPHERES **c92**
W.-H. Ip *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 65-82 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

Direct interaction between the solar wind plasma and the neutral atmospheres of comets, Venus, Titan, and Mars is discussed. Space observations of the corresponding plasma processes and structures are reviewed. Prospects of research are considered. Author (ESA)

N86-27337# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio INterplanetario.
COLLISIONLESS SHOCK WAVES IN SPACE AND IN ASTROPHYSICS **c75**
V. Formisano *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 83-100 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

The state of knowledge on collisionless shock waves in space plasma since the ISEE missions is reviewed. The dissipation mechanism, areas where progress is scarce, and the possibility of transferring knowledge to astrophysical shocks are discussed. For the laminar quasiperpendicular dispersive shock, the dissipation mechanism is the modified two stream instability which heats the electrons and the ions. For other shock structures, the mechanism is unclear. Astrophysical shocks have extreme values for the characteristic parameters, therefore it is necessary to explore in the solar system (in space) shocks which extend, in parameter space, the region explored until now. Coronal shocks could be the link between space observations and astrophysical shocks. Author (ESA)

N86-27338# Ruhr Univ., Bochum (West Germany).
PLASMOIDS IN PLANETARY MAGNETIC FIELDS AND THE SOLAR CORONA **c90**
Karl Schindler *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 101-105 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

The formation and acceleration of plasmoids, observed in the laboratory, in the magnetosphere, and in the solar atmosphere are discussed. Results suggest that the formation and ejection of plasmoids is a dominant loss process for mass and energy accumulated in closed flux regions in the magnetic field of planets and stars, under nearly ideal MHD conditions. Formation occurs via an instability if, during energy storage, nonideal plasma effects become important. The instability is based on the attraction of parallel electric current. This phenomenon is a (partial) collapse of a portion of the plasma sheet. The accelerating forces arise from the change of topology of the magnetic field by spontaneous magnetic reconnection. Observationally, the separation of space and time dependence is essential to study plasmoid magnetic topology, the three dimensional plasma structure including superthermal population and ionic composition, and the basic dissipation mechanism. Author (ESA)

N86-27339# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
MAGNETOSPHERE-IONOSPHERIC COUPLING **c46**
C.-G. Faelthammar *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 107-133 Original language document was announced as N86-24071 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

Magnetosphere-ionosphere coupling, and the role of Birkeland currents, magnetic field aligned electric fields, and Alfven waves are discussed. In addition to transporting energy and momentum between the magnetosphere and the ionosphere, the Birkeland current cause a redistribution of matter within and between these regions. They do so directly via exchange of charge carriers, and indirectly via instabilities and acceleration processes that they excite in the plasmas. The spatial distribution of magnetic field aligned electric fields, and the way they are supported are unclear. Changes in electric fields and plasma convection are communicated between the magnetosphere and the ionsophere by Alfven waves. Observations of high power low frequency noise, which fits an Alfven wave discription, and which has a net downward Poynting flux of 100 million W integrated over the auroral regions are reported. Individual Alfven waves, upward and downward propagating, are observed. Oblique Alfven waves are a key feature of a model for auroral arc formation. Author (ESA)

N86-27340# Saint Andrews Univ. (Scotland). Dept. of Applied Mathematics.
SMALL-SCALE RECONNECTION **c75**
E. R. Priest *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 137-149 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

The theory, and examples of magnetic reconnection of cosmic plasma are discussed. The theory of reconnection consists of two branches: linear tearing modes and the fast nonlinear state of Petschek-Sonnerup reconnection. Developments linked them and reveal two fast unsteady regimes: the flux pile-up and the impulsive bursty regime. Applications include: mini flux transfer events discovered by the AMPTE satellite at the magnetopause; cancelling magnetic features in photospheric magnetograms form Big Bear Solar Observatory; and the heating of the solar corona by tearing turbulence at many small curent sheets. Author (ESA)

N86-27341# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
GENERATION OF FIELD-ALIGNED CURRENT STRUCTURES AT SUBSTORM ONSETS **c46**
A. Roux *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 151-159 (For primary document see N86-27330 18-12)

Avail: NTIS HC A12/MF A01

The sharp transition between tail and dipole-like magnetic configurations which develops prior to the onset of magnetospheric substorms is discussed. It is shown that this boundary is unstable to westward traveling waves which are fed at the expense of azimuthaly drifting energetic ions in the restored dipolar configuration. Evidence that the surges observed simultaneoulsy on the ground are the projection along geomagnetic field lines of this distorted (unstable) boundary is given. Medium scale field aligned current structures are shown to develop as a result of this instability process and to tend to cascade towards smaller scale structures. Electron acceleration correlates very well with these small scale structures. Author (ESA)

N86-27342# Oxford Univ. (England). Dept. of Theoretical Physics.

HIGH RESOLUTION OBSERVATIONS OF MAGNETIC STRUCTURES **c92**

C. Jordan *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 161-167 (For primary document see N86-27330 18-12)

Avail: NTIS HC A12/MF A01

High resolution observations in the ultraviolet spectral region to study the structure and energy balance of the solar atmosphere are discussed. Observations with high spatial and spectral resolution show structure in the quiet and active atmosphere on the 1 arcsec scale. In addition to the all pervasive nonthermal line broadening, such observations show small regions where unusally large line widths and line shifts exist. Their relation to heating processes and mass flux deserves further study. Observations required to investigate the existence of wave heating modes are discussed, emphasizing the importance of simultaneous measurements of line fluxes, electron densities, and line profiles. The SOHO mission provides an excellent opportunity to resolve the issue of coronal heating. Author (ESA)

N86-27343# Observatoire de Paris-Meudon (France).

SOLAR FINE STRUCTURES: THEIR IMPORTANCE IN THE SUN'S PHYSICS AND THEIR OBSERVATION **c92**

J. Heyvaerts *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 169-174 (For primary document see N86-27330 18-12)

Avail: NTIS HC A12/MF A01

Structures in the Sun's atmosphere are reviewed. The essential role of these structures in the physics of the Sun's convective zone and atmosphere is stressed, and it is emphasized that the same physics is crucial in a number of other systems of planetological or astrophysical interest. The problem of solar coronal heating is considered, and its relation to the solar wind acceleration problem is discussed. The diagnosing of nonthermal heating phenomena is shown to involve elaborate observations with high spectral, spatial and temporal resolution. It is concluded that the SOHO project appears to be the best step to take. Author (ESA)

N86-27344# Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.

CHARACTERISTIC PHENOMENA OF MAGNETOHYDRODYNAMIC TURBULENCE **c75**

D. Montgomery *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 175-179 (For primary document see N86-27330 18-12)

(Grant NAGw-719; Contract DE-FG02-85ER-53194)

Avail: NTIS HC A12/MF A01

Magnetohydrodynamic (MHD) turbulence theory is reviewed. Mangetic X points, vorticity quadropoles, concentrated current filaments, highly anisotropic spectra, selective decay and dynamic alignment phenomena (charaterized by highly unequal dissipation rates for global ideal invariants), and kinking turbulence for plasmas which carry strong currents are reviewed. The most useful tool for obtaining accurate information about turbulent dynamics is numerical solution of the MHD equations. Author (ESA)

N86-27345# Cambridge Univ. (England). Inst. of Astronomy.

THEORY OF SOLAR OSCILLATIONS **c92**

D. O. Gough *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 183-197 (For primary document see N86-27330 18-12)

Avail: NTIS HC A12/MF A01

Analyses of helioseismological data, and the theoretical issues they raise are discussed to illustrate how measurements influence concepts of the solar interior, and to suggest avenues of enquiry. The properties of resonant modes of oscillation are reviewed, to illustrate which aspects of the solar structure can be measured from their frequencies. A determination of the variation of sound speed through much of the interior of the Sun is described. The measurement reveals at least one error in a theoretical solar model, and suggests the presence of macroscopic motion in the solar core. More sophisticated analyses of the data should provide important diagnostics of the outer layers of the Sun, to improve understanding of the dynamics of the convetions zone.

Author (ESA)

N86-27346# National Optical Astronomy Lab. Tucson, Ariz. National Solar Observatory.

HIGH-RESOLUTION HELIOSEISMOLOGY **c92**

J. Harvey *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 199-208 Sponsored by NSF (For primary document see N86-27330 18-12)

Avail: NTIS HC A12/MF A01

The basic method of helioseismology, considerations important in designing an instrument to obtain the required observations, the status of observational techniques, and results and advantages of space observations are reviewed. High resolution of solar interior conditions in radius, latitude, longitude, and time requires observations of as many different modes of oscillation as possible. Such observations can be made by measuring oscillations of brightness or the Doppler shift of suitable spectrum lines. To observe the maximum number of different modes requires angular resolution of 2 arc sec over the entire disk and time resolution of 100 sec for a duration of months. However, much can be learned with less highly resolved images. Ground based observations are limited by atmospheric blurring and by diurnal sampling distortions. By avoiding these problems the SOHO mission offers an excellent opportunity for a major advance in understanding of the solar interior. Author (ESA)

N86-27347# Observatoire du Mont-Gros, Nice (France).

GLOBAL OSCILLATIONS **c92**

E. Fossat *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 209-217 (For primary document see N86-27330 18-12)

Avail: NTIS HC A12/MF A01

The use of pressure modes to probe the deepest layers of the Sun's internal structure is discussed. It is noted that models featuring diffusion in the core satisfying neutrino flux are incompatible with helioseismological data. The contribution expected from gravity mode observations is assessed. The levels of solar and atmospheric noise encountered in Doppler and irradiance measurements are considered. Improvements in observational accuracy possible with SOHO project are reviewed. Author (ESA)

N86-27348# Observatoire de Paris-Meudon (France).

SOLAR/SPECTRA CONNECTIONS **c92**

F. Praderie *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 219-228 (For primary document see N86-27330 18-12)

Avail: NTIS HC A12/MF A01

The hydrodynamics of stellar interiors are discussed. For the diagnostics of phenomena at the stellar surface whose seat is deep below, variability studies play an increasingly important role. Stars are analyzed as magnetic variables, to gain information on the dynamo-generated surface magnetic field, and pulsating variables, in as much as nonradial oscillations probe the structure and dynamical state of the interior. The need for a long term spaceborne monitoring project consisting of a photometric channel

(for stellar seismology) and a spectroscopic one (for stellar magnetometry) via activity studies at various altitudes and with time is stressed. Author (ESA)

N86-27649*# Naples Univ. (Italy). Istituto Aerodinamica U. Nobile.
TETHERED ELEVATOR: A UNIQUE OPPORTUNITY FOR SPACE PROCESSING
Rodolfo Monti *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 137-147 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N86-27349# Optimization, Inc., Blacksburg, Va.
ORBITAL-MANEUVER-SEQUENCE OPTIMIZATION Final Report, 1 Jun. 1984 - 31 Aug. 1985
H. J. Kelley, E. M. Cliff, and F. H. Lutze Dec. 1985 146 p
(Contract F04611-84-C-0014)
(AD-A165138; K505-1; AFRPL-TR-85-090) Avail: NTIS HC A07/MF A01 CSCL 22/1

This 15 month effort developed an orbital maneuver sequence optimization computer program and applied it to the generation of optimal co-orbital attack maneuver sequences and to the generation of optimal evasion and return maneuver sequences. Rocket burns were modeled as impulse and coasts as conic arcs, or as near circular orbit approximations thereto. Parameters consisting of impulse components and coast lengths are adjusted iteratively by a variable metric (BFGS) gradient process with projection treatment of constraints. A minimum radius component, not ordinarily included in orbit transfer optimization studies, proved to be important for co-orbital attack maneuver sequences. Families of such sequences are explored and the effects of various operational constraints investigated. Optimal in plane evasive maneuvering is studied subject to return-to-orbit and return-to-position in orbit constraints. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N86-27391# European Space Tribology Lab., Risley (England).
THERMAL VACUUM INCLINOMETRY: A TEST FACILITY FOR ANTENNA POINTING MECHANISMS
E. W. Roberts *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 261-265 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N86-27350# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). FMP Working Group WG-12.
VALIDATION OF MISSILE SYSTEM SIMULATION Final Report
Nov. 1985 114 p
(AGARD-AR-206; ISBN-92-835-1514-5) Avail: NTIS HC A06/MF A01

A survey of missile simulation facilities in 1982 indicated that very little was devoted to the validation of missile system simulations. The validation techniques that are used are not standardized, often ill defined, and generally undocumented. In an attempt to rectify this situation, missile simulation procedures were examined and techniques for the validation and universalization of the results were recommended. A simulation terminology that, if adopted, should simplify the validation process is recommended. A hierarchical model representation called, Confidence Level in Model Behavior (CLIMB), is also recommended to organize the simulation process. A standardized documentation procedure is emphasized which both simplifies the orderly use of simulation and insures confidence in the final simulation results. Examples of using CLIMB are included. Computer languages and how they can benefit the simulation process are discussed. Software verification, validation, and assessment methods are examined. Recommendations were made to enhance the validation of the simulation. Author

N86-27395# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
ARIANE RELEASE GEAR SYSTEM
P. McMahon *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 289-296 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27396# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
ARIANE 3RD STAGE PRESSURE CONTROL VALVES
C. B. Taylor *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 297-303 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N86-27351*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PARTICULATE CONTAMINANT RELOCATION DURING SHUTTLE ASCENT
John J. Scialdone Jun. 1986 17 p
(NASA-TM-87794; NAS 1.15:87794; Rept-86B0432) Avail: NTIS HC A02/MF A01 CSCL 22B

The dislodgement, venting, and redeposition of particles on a surface in the shuttle bay by the vibroacoustic, gravitational, and aerodynamic forces present during shuttle ascent have been investigated. The particles of different sizes which are displaced, vented, and redistributed have been calculated; and an estimate of the increased number of particles on certain surfaces and the decrease on others has been indicated. The average sizes, velocities, and length of time for certain particles to leave the bay following initial shuttle doors opening and thermal tests have been calculated based on indirect data obtained during several shuttle flights. Suggestions for future measurements and observations to characterize the particulate environment and the techniques to limit the in-orbit particulate contamination of surfaces and environment have been offered. Author

N86-27352*# National Aeronautics and Space Administration, Washington, D.C.
ACTIONS TO IMPLEMENT THE RECOMMENDATIONS OF THE PRESIDENTIAL COMMISSION ON THE SPACE SHUTTLE CHALLENGER ACCIDENT. REPORT TO THE PRESIDENT
14 Jul. 1986 52 p
Avail: NTIS HC A04/MF A01 CSCL 05A

The status of the implementation of the recommendations of the Presidential Commission on the Space Shuttle Challenger Accident is reported. The implementation of recommendations in the following areas is detailed: (1) solid rocket motor design; (2) shuttle management structure, including the shuttle safety panel and astronauts in management; (3) critical item review and hazard analysis; (4) safety organization; (5) improved communication; (6) landing safety; (7) launch abort and crew escape; (8) flight rate; and (9) maintenance safeguards. Supporting memoranda and communications from NASA are appended. J.P.B.

N86-27656*# British Columbia Univ., Vancouver.
EFFECTS OF DAMPING ON THE CONTROL DYNAMICS OF THE SPACE SHUTTLE BASED ON TETHERED SYSTEMS
V. J. Modi *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 357-382 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N86-27353# European Space Agency, Paris (France).
SECOND EUROPEAN SPACE MECHANISMS AND TRIBOLOGY SYMPOSIUM
T. D. Guyenne, comp. and J. Hunt, comp. Dec. 1985 327 p In ENGLISH and FRENCH Symposium held in Schloss Meersburg, West Germany, 9-11 Oct. 1985; sponsored by ESA, Dornier-Werke GmbH, and DFVLR
(ESA-SP-231; ESA-86-96851) Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Spacecraft mechanisms; motors and actuators; tribology; space stations; and mechanism analysis and testing were discussed. For individual titles, see N86-27354 through N86-27397.

N86-27354# Rockwell International Corp., Downey, Calif.
OPERATIONAL FLIGHT EXPERIENCE AND DISASSEMBLY/INSPECTION RESULTS OF SPACE SHUTTLE ORBITER ACTUATORS
D. Woolhouse *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 3-8 (For primary document see N86-27353 18-18)
(Contract NAS9-14000)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

After completion of the first six flights of Space Shuttle Columbia, the four rudder/speedbrake rotary actuators were removed so that a complete disassembly and inspection could be accomplished to evaluate the condition of all internal components. The flight loads experienced by the actuators are compared to those used in designing them. The combination of materials employed for the gear train and lubrication system of the Space Shuttle rudder/speedbrake rotary actuators successfully withstands all stresses and loads encountered during six orbital flights and six years of environmental exposure. Care should be exercised when choosing off-the-shelf or catalog parts (e.g., bearings, rollers, and spacers) to ensure that the same attention to surface protection is exercised as is typically given to custom designed parts. The requirement imposed on this design for operation during 100 missions over a 10 year period can be met as demonstrated by the excellent condition of these units after their flight exposure. ESA

N86-27355# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
THE SUCCESSFUL MAIDEN FLIGHT OF THE INSTRUMENT POINTING SYSTEM
K. Suttner *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 9-12 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Operation on flight STS-51 F of the Intrument Pointing System (IPS), a facility for pointing and stabilizing payloads of up to 3000 kg in the arcsec range, is summarized. After initial problems due to software and optics deficiencies were corrected, the mechanism behaved absolutely normally throughout the flight, as shown when such downlink data as actuator currents, run time, end switch timing, and temperatures are compared with those from ground tests. ESA

N86-27356# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
FEATURES OF THE SOLAR ARRAY DRIVE MECHANISM FOR THE SPACE TELESCOPE
R. G. Hostemkamp *In* ESA Second European and Space Mechanisms and Tribology Symposium Dec. 1985 p 13-17 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Spacecraft mechanisms; motors and actuators; tribology; space stations; and mechanism analysis and testing were discussed. The Solar Array Drive Mechanism for the Space Telescope is described. Power and signal transfer is achieved by a flexible wire harness for which the chosen solution, consisting of 168 standard wires, is described. The torque performance data of the harness over its temperature range is presented. The off load system which protects the bearings from the launch loads is released by a trigger made from Nitinol, a memory alloy. The benefits of memory alloy and the caveats for the design are discussed. The design of the off load is outlined and test experience reported. ESA

N86-27357# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
HISTORICAL DEVELOPMENT OF SOLAR ARRAY DRIVE MECHANISMS BY BRITISH AEROSPACE c37
I. D. Henderson *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 19-24 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Solar array drive mechanisms are described. Design and technical features of the Bearing and Power Transfer Assembly and the solar array drive mechanisms for Olympus and Eurostar

satellites are outlined. Arrays for large space platforms are considered. ESA

N86-27358# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
ANALYSIS OF IN-ORBIT PERFORMANCE OF MECHANISMS WITHIN LARGE STRUCTURES
H. Baier *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 29-34 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Simulating and predicting the behavior of spacecraft mechanisms especially within larger structures are discussed. Deployment kinematic analysis is outlined. Actuators and their transfer functions within an active isolation or damping system as well as investigations of the static behavior of a refocus mechanism and the dynamic behavior of a bearing and power transfer assembly are treated. For the latter case, the effects of nonlinearities and of static preloads are emphasized. Ways to verify mechanism behavior in flexible structures are summarized. ESA

N86-27359# Technische Univ., Brunswick (West Germany). Inst. fuer Angewandte Mechanik.
CONTROL OF FLEXIBLE STRUCTURES WITH RESPECT TO INFINITY
P. Ruge *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 35-39 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The transfer matrix method is recommended for studying the stability of linear feedback controlled systems continuous in space and time. The system matrix can be assembled as it is used from finite element methods separately for each continuous member and each joint including control elements. Distributed transfer matrices for the continuous members which contain information up to infinity without poles and truncation errors are used. The calculation of as many eigenvalues as wanted is carried out by trace theorems. ESA

N86-27360# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. des Systemes Balistiques et Spatiaux.
SOLAR ARRAY DEPLOYMENT SIMULATION USING ADAMS SOFTWARE **c44**
C. Roux and P. Flament *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 41-46 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The use of ADAMS program to predict dynamic phenomena during deployment of satellite solar arrays is reviewed. The program increases understanding of influences of constituent flexibility during deployment. The program contributes to optimization of the mechanism as to mechanical strength under deployment loads and latching shocks; motorization factor; and layout on the solar array. Prediction of all in orbit deployment cases (including possible failure cases) in order to be sure that no unexpected phenomenon perturb the space flight is also improved. The improved accuracy using ADAMS is verified by test prediction correlation. ESA

N86-27361# Societe Europeenne de Propulsion, Vernon (France).
GIOTTO DESPIN MECHANISM SUBSYSTEM: GENERAL LOOP DESIGN AND POINTING ASPECTS
G. Turin *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 47-52 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The Giotto spacecraft despin antenna subsystem used to orient the high gain antenna towards the far Earth, while the satellite is spin stabilized at 15 rpm is described. The despin antenna subsystem control loop behavior in environmental tests and in flight is summarized. The subsystem was launched, unlocked, and put in rotation succesfully. The precision is within the deadband, better than +/- 0.022 degrees (better than half specification). This shows that the concept of a stepper motor in open loop is safe, although an alternative is to increase the damping ratio; simulations show that 1% is sufficient. Strong control on the potential perturbation is also necessary. For example, the least correction must be lower than calculated for a normal linear system. The results from calculation assuming a linear system are optimistic. ESA

N86-27362# Technische Univ., Munich (West Germany).
TRAJECTORY PLANNING FOR MANIPULATOR SYSTEMS **c37**
F. Pfeiffer *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 53-58 (For primary document see N86-27353 18-18)
(Contract SV-I/61-288)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

For the combination of an arbitrary manipulator and a given trajectory, a method which allows a simple evaluation of time optimal trajectory motion and the consideration of any other performance criterion is presented. The idea that path tracking of a manipulator may be regarded as approximately a one degree of freedom motion leads to a set of nonlinear differential equations which can be used to determine the state space constraints caused by geometric constraints and torque/force limitations in the joints. The equations of motion and their formal quadrature are used to construct a field of extremals in the state-plane, which defines in a transparent way the time-minimum solution. More general performance criteria are considered by the application of a dynamic programming approach. ESA

N86-27363# Technische Univ., Munich (West Germany). Lehrstuhl B fuer Mechanik.
MODELING AND CONTROL OF A LIGHTWEIGHT ROBOT **c37**
B. Gebler *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 59-64 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

For a lightweight industrial robot the influence of elasticity of the structural parts is studied. The system is modeled as a hybrid multibody system. It is shown that using the static deflection bending lines as shape functions yields, with only a few degrees of freedom, very good results. For control of the system, consideration of nominal deflections is proposed. This concept takes into account the elastic properties of robot arms when computing feedforward control torques. ESA

N86-27364# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
THE EXTENDABLE AND RETRACTABLE MAST (ERM)
M. Schmid and M. Aguirre *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 69-74 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The Extendable and Retractable Mast (ERM) used to deploy and retract large foldable structures such as solar arrays and furlable spacecraft antennas is presented. The design is based on a telescopic carbon-fiber structure with high stiffness, strength, and pointing accuracy. To verify the chosen design a breadboard model of an ERM was built and tested under TV conditions. ESA

N86-27365# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
THE COLLAPSIBLE TUBE MAST (CTM)
M. Aguirre, A. Bureo, M. Fuentes, and J. Rivacoba *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 75-81 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member

States, AU, CN, NO (+20% others)

A biconvex tube mast that can be flattened and rolled around a drum into a small volume package is described. A drive system pulls the tube by the edges to deploy it, and rotates the stowing drum to retract it. The mast can be manufactured in metal or composite; in both cases a continuous manufacturing method is used, providing a mast of unlimited length. An engineering model with tubes in copper beryllium and carbon fiber reinforced epoxy and thermoplastic is planned. ESA

N86-27366# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
BRITISH AEROSPACE MECHANICS FOR INTELSAT 6
G. J. Sturtivant *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 83-88 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Mechanisms for the INTELSAT 6 program to clamp, release, stabilize, and deploy the satellite assembly from an STS Orbiter launch are described. They can be refurbished and reused for a minimum of 16 flights, while the single operation spring ejector mechanism also provides the separation of the perigee stage from the satellite. The design of the mechanisms achieves simplicity, low mass, high load capability, and reliable functional capability mechanisms. ESA

N86-27367# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
THERMAL CUTTING HOLDDOWN AND RELEASE MECHANISM **c37**
G. J. A. N. Kester *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 89-93 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

A restraint and release mechanism was invented and tested in the Advanced Rigid Array program. The invention degrades the mechanical properties of a restraining element like an aramid cable by means of a heat source. The performance specifications and test results are listed. The benefits of using this mechanism instead of pyrotechnic systems include higher reliability, low cost and mass, long term storage, and the possibility of prelaunch testing. ESA

N86-27368# Sener, S.A., Madrid (Spain).
THE ULYSSES MECHANISMS
F. Abarrategui, M. Fuentes, S. Ugaldea, and M. Aguirre *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 95-104 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The Ulysses (ex ISPM) radial boom, two wire booms, and a rigid axial boom are described. The radial boom is used to deploy five experiment sensors away from the spacecraft body. It is constructed with nonmagnetic materials, and consists of two articulated arms. The wire boom antennas when deployed form a 72 m tip-to-tip dipole for the radio and plasma wave experiment. The antenna element is a tape of 5 x 0.04 mm section in CuBe2 material. The axial boom antenna, located at the spinning axis, is used as a monopole antenna by the radio and plasma wave experiment. The antenna consists of a tube of lenticular section. The section shape permits the tube to be pressed flat and rolled into a drum. ESA

N86-27369# Societe Nationale Industrielle Aerospatiale, Cannes (France).
SPEED REGULATORS FOR SPACE APPENDAGES DEPLOYMENT
J. M. Leblanc *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 105-111 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The requirements, design, test program, and performances of a centrifugal brake speed regulator for the deployment of space-borne appendages are described. The regulator is qualified for the SPOT solar array, the TVSAT/TDF reflectors, and TELE-X reflectors. ESA

N86-27370# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
SEMI-ACTIVE MAGNETIC BEARINGS FOR SPACE APPLICATIONS **c37**
M. Gauthier and C. Rouyer *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 115-120 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Magnetic and ball bearings for satellite inertia wheels are compared. For momentum wheels magnetic bearings have the advantage over ball bearings for high kinetic momentum (150 Nms and over). For smaller kinetic momentum, this advantage still exists given that no redundancy of the mechanical part is required. For reaction wheels, the advantage of the magnetic bearing is chiefly related to the low friction and stiction torques, and the choice is dictated by the mission requirements. The same conclusions apply to optical systems. For kinetic energy storage, magnetic bearings are mandatory to reach competitive performance. The flight qualification obtained with the SPOT satellite and the development of high speed rotors for kinetic energy storage are discussed. ESA

N86-27371# Technische Univ., Brunswick (West Germany). Inst. fuer Elekt. Maschinen, Antriebe, und Bahnen.
DIRECTLY-DRIVEN SERVOMOTOR WITH VERY HIGH TORQUE **c33**
H. Weh, P.-Chr. Leymann, and W. Niemann *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 121-126 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

A direct drive for robot applications is described. The motor operates as a permanently excited synchronous machine, whereby the proportion of magnetic material can be minimized owing to the rotor construction. It develops a continual torque of 827 Nm for an outer diameter of 386 mm and can be directly incorporated into the articulated arm. A microcomputer assumes the position and rotation speed regulation as well as the control of the multiphase pulse converter, which supplies the stator with square-wave current pulses. ESA

N86-27372# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
TORQUE IRREGULARITIES IN REACTION WHEELS
R. Stapf, Th. Lange, and H. Holzach *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 127-131 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Experimental investigations on torque irregularities in reaction wheels revealed two classes of unexpected effects: Frictional effects, which can be interpreted with Dahl's model of solid friction; and effects due to electromagnetic interactions in the dc motor. An extreme dependency of the wheel start-up current on the rotor's angular position is emphasized. Equidistant current spikes exceeding the nominal start current up to one order of magnitude are found, producing an exceptionally high start-up torque. ESA

N86-27373# Societe Europeenne de Propulsion, Vernon (France).
ELECTRIC MOTOR WITH SUPERCONDUCTING WINDINGS FOR ACTUATION MECHANISM IN THE FOCAL PLANE OF A SPACE CRYOSTAT **c33**
J. P. Bugeat, R. Petit, D. Valentian, M. Junca, and M. Verain *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 133-138 (For primary document see N86-27353 18-18)

(Contract ESA-5609/83)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

An electric motor for the Infrared Space Observatory was tested. This stepper motor derived from a space qualified component is able to run under vacuum at liquid helium temperatures. Its superconducting winding allows it to run with an electrical heat dissipation of less than 1 mW. Themotor test program included endurance tests at cryogenic temperatures (10K) and vibration tests at liquid nitrogen temperature. The motor torque was measured down to 8K. ESA

N86-27374# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
PYROTECHNIC VALVES, MINIATURE PYROMECHANISMS, AND PYROTECHNIC NUTS c28
J. C. Slama *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 139-143 In FRENCH (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Pyrotechnic valves for isolating two parts of launch vehicle fluid circuits before activation and for shutting off a feed circuit are described. Miniature pyrotechnic actuators for deployment, retraction, and cutting mechanisms for payloads on manned vehicles are presented. A reusable pyrotechnic release nut for rocket payloads (e.g., a complete satellite or an antenna) is presented. ESA

N86-27375# Centre National d'Etudes Spatiales, Toulouse (France).
DEFINITION AND TESTING OF GEARS FOR SPACE ROBOTICS c37
L. Petitjean and A. Borrien *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 149-154 In FRENCH; ENGLISH summary (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

An automatic manipulator arm for the capture of a three-axis stabilized satellite by another satellite on the same orbit was investigated. A general design study highlighted critical technological problems, such as the design and manufacturing of the joint gear-boxes, as the joints must transmit high forces and torques (60 Nm holding torque) which induce high contact stresses on the gear teeth. The research in lubrication processes, the experimental program to prove the feasibility of the concept, and the test results under atmosphere are summarized. ESA

N86-27376# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Technische Physik.
THE PERFORMANCE OF UNBONDED MoS2 FOR SPACE APPLICATIONS c27
V. Buck *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 155-159 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The performance of MoS2 as a dry lubricant in general is outlined and the advantages and disadvantages for space applications are reviewed. Knowledge in sputtering of MoS2 is discussed and the influence of preparation conditions on impurities or disorder of the films is assessed. Results showing correlations between H2O impurities in the plasma and structural parameters of the layers are given, and the importance of these effects is outlined. Considerations relating structural properties to tribological behavior are presented. ESA

N86-27377# Centre Suisse de Documentation dans le Domaine de la Microtechnique, Neuchatel. Dept. de Recherche et Developpement.
COATINGS AGAINST FRETTING c27
M. Maillat and H. E. Hintermann *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 161-166 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Coatings and lubricants to protect aerospace mechanisms from wear and microweldings caused by fretting or reciprocal sliding were investigated. From the 144 tests performed, TiC, Tiodize and Adhesoil coatings show the best results under a high specific load; the best results are obtained with Rh + MoS2 coatings under low contact pressure against Be. ESA

N86-27378# European Space Tribology Lab., Risley (England).
SURFACE-TREATED TITANIUM ALLOY GEARS FOR SPACE MECHANISMS c37
R. A. Rowntree *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 167-171 Sponsored by ESTEC (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The performance of surface treatments against adhesive wear (galling) on the alloy IMI 318 (Ti-6Al-4V) was tested using gears unlubricated in vacuum, in a four square rig. Gear performance was determined by life or number of tooth encounters before failure of the surface treatment rather than by wear depth. Conventional treatments such as nitriding or oxidation are found to offer limited improved gear life, above that of the untreated alloy. Boronizing gives the longest gear life but causes, during treatment, dimensional growth of the gears. Sputter-deposited coatings of TiN are poorly adherent to the substrate and give short lives. Arc-evaporated coatings of TiN give improved performance until coating fracture and subsequent galling of the titanium alloy occurs. ESA

N86-27379# Societe Nationale Industrielle Aerospatiale, Cannes (France).
USE OF MoS2 APPLIED BY PHYSICAL VAPOR DEPOSITION (PVD) ON SPACE MECHANISMS c27
J. F. Patin, M. Maillat (Centre Suisse de Documentation dans le Domaine de la Microtechnique, Neuchatel.), and H. E. Hintermann *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 173-176 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Satellite mechanisms using a solid lubricant film of MoS2 applied by physical vapor deposition or RF sputtering are described. This process satisfies space requirements because MoS2 has excellent friction properties in vacuum; nevertheless it is necessary to take into account moisture effects during ground tests. Parameters likely to influence the performances of lubricated mechanisms were studied on a pin on disk tribological test rig. Sputter coated MoS2 films are successfully used in the telecommunication satellite Arabsat, the observation satellite SPOT, and the television satellite TDF. Examples of lubricated mechanisms are antennas, rigid solar array deployment mechanisms, and flexible solar array box opening mechanisms. ESA

N86-27380# Spar Aerospace Ltd., Ste-Anne-de-Bellevue (Quebec).
DESIGN AND TEST OF A LINEAR THERMAL ACTUATOR c33
G. Bush, D. Osborne, and V. A. Wehrle *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 181-185 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

A linear thermal actuator (LTA) to serve as the actuating element of a shape control system which compensates actively for deployment inaccuracies or thermal distortions of large antennas or other space structures requiring high dimensional stability was developed. The LTA was subjected to spacecraft-level vibration and thermal vacuum tests. Results and effect on ambient performance are presented. A follow-on development effort in which it is proposed to incorporate a network of distributed

LTAs into a shape control system for a phased-array planar antenna of a hypothetical ice surveillance satellite is outlined. ESA

N86-27381# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
A COARSE POINTING MECHANISM FOR AN INTERSATELLITE LASER LINK (ISL2) SYSTEM c37
R. Kern and K. Kierschke *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 187-192 (For primary document see N86-27353 18-18)
(ESA-86-96851; ESA-SP-231) Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The basic structure and principle of operation of a Pointing, Acquisition, and Tracking Subsystem (PATS) for intersatellite laser links, especially by using CO2 lasers, are described. The Coarse Pointing Assembly features the largest dimensions and requires thorough design considerations to keep its mass at a minimum. In spite of a possibly lightweight construction, the high accuracy requirements for the CPA have to be met. A trade-off of potential CPA mechanisms was made and the resulting design is presented. The gear design, the pick-off approach, the bearings arrangement, and the motor are discussed. The control law and its realization in connection with the complete PATS are considered. ESA

N86-27382# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
DEVELOPMENT AND TESTING OF A DUAL-WOUND dc MOTOR GEARHEAD c37
B. W. Henson and J. C. Anderson (European Space Tribology Lab., Risley (England).) *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 193-200 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The development and testing of a dual-wound dc motor and integral gearhead are described. Extensive testing proves its ability to operate in vacuum over the temperature range -45 to +85C with a life greater than 250 hours. The unit has a rated torque output of 1.5 Nm with a nominal output speed of 30 rpm and could be used as a prime mover in many medium speed space applications. Its high overall efficiency means that it can be backdriven. ESA

N86-27383# Indian Space Research Organization, Trivandrum. Vikram Sarabhai Space Center.
DESIGN AND DEVELOPMENT OF A BRUSHLESS dc MOTOR FOR SPACE APPLICATIONS c33
N. Kannan, A. Bose, and N. Vedachalam *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 201-206 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

A brushless dc motor for momentum/reaction wheel applications was developed. Ironless armature is adopted and trapezoidal torque function is achieved, making effective use of a high coercive rare earth cobalt permanent magnet for the field system. The magnet rotor position sensing for electronic commutation is accomplished with high resolution optical reflective sensors. The performance tests for characterization of the motor parameters are presented. ESA

N86-27384# Moore Reed and Co. Ltd., Walworth (England).
A SPACE-COMPATIBLE ANGULAR CONTACT ENCODER c33
A. R. Flew *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 207-212 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

An electromechanical digital position encoder, based on existing commercial technology, for spacecraft applications is described. The device contains electrical wiping contacts, a gear mechanism, and plain and rolling-element bearings all operating without wet lubrication. Designed to function continuously for 10 years, certain contacts will perform in excess of 20 million cycles. To investigate the performance of these contacts, automatic test equipment was designed to monitor the accuracy of 8192 separate output conditions on a regular basis throughout an accelerated-life thermal vacuum test. The equipment also checks for missing bits and edge noise and logs any errors that are found. ESA

N86-27385# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
INTEGRATED SENSOR AND ACTUATOR SYSTEM FOR FLEXIBLE SPACE STRUCTURE EXPERIMENTS c19
Th. Lange and H. Holzach *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 217-220 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

A high accuracy sensor and actuator system for laboratory experiments on flexible structure control, comprising an optical sensor and a magnetic actuator, is presented. It features high linearity and large bandwidth. A special wiring profile was realized for the actuator coil to generate a constant magnetic driving field in a defined working space. This design prevents force variations as a result of relative displacement. The performance is confirmed by tests and experiments. ESA

N86-27386# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
EXPERIMENT MANIPULATORS FOR AUTOMATIC SAMPLE HANDLING c37
N. Cable *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 221-226 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The application of robotics to small scale manipulator systems for materials handling in microgravity was studied, using the single core payload of EURECA. A skeleton and an advanced concept were studied. Modularity; size and mass; joint design; sensors; reliability, safety and redundancy; orbit and ground operation; computer aided design; end effectors; grapple fixtures; storage and process interfaces; processors; software; and the use of commercially available manipulators were investigated. ESA

N86-27387# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
A DORNIER LATCH DESIGN FOR A DOCKING MECHANISM c37
K. Priesett, F. Gampe, R. H. Bentall, and N. Cable *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 227-232 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Within a technology study of a spacecraft docking mechanism subsystem, it is shown that based on the selection of a very low impact docking concept, a simple latching and connecting interface can be applied to the coupling of two spacecraft. Structural joining is accomplished by three or four equispaced capture latches. A capture latch mechanism for this docking technique is described. Latching requirements, the standard docking interface, the latch mechanism design and analysis, and results of a predevelopment model latch test are outlined. ESA

N86-27388# Sener, S.A., Madrid (Spain).
A SENER LATCH DESIGN FOR DOCKING MECHANISMS c37
F. Abarrategui, M. Fuentes, J. Rivacoba, and J. A. Ros *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 233-238 (For primary document see N86-27353 18-18)
(Contract ESA-5195/82-NL-BI)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Latch mechanisms were designed for the docking of two spacecrafts at relatively short distances and with small relative

velocity between them. The mechanism mounted on one of the spacecrafts has to receive the passive element of the other, guide it, dissipate as much as possible the small relative kinetic energy, stop it, bring it to the final rest position, and rigidize the interface between both spacecraft. The mechanism elements necessary to carry out this task and the operation of the latch in the process of docking and undocking are explained. A model of the latch was built and tested in a bidimensional air bearing set-up. ESA

N86-27389# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Space Div.
A DEPLOYABLE AND RETRACTABLE STRONGBACK STRUCTURE
R. Zwanenburg *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 239-245 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

A deployable/retractable structure whose parts deploy or retract simultaneously was developed for spacecraft antennas, solar arrays, heat rejection systems, sensors, concentrators, and platforms. Its advantages include simplicity and high reliability; excellent strength and stiffness in deployed condition; high design flexibility without the need for complete redesign; low production cost due to large number of identical elements; low development effort; and simple ground testing. ESA

N86-27390# European Space Tribology Lab., Risley (England).
SOME RECENT EXPERIENCES OF MECHANISM PERFORMANCE AND COMPONENT ASSESSMENT IN THERMAL VACUUM TESTS AT ESTL
J. A. Duvall and K. Parker *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 251-260 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The spacecraft mechanism test facilities at the European Space Tribology Laboratory (ESTL) are described. Test results are reviewed on three mechanisms where, in a variety of thermal conditions, the measurement of the reaction torque which would be experienced by the spacecraft was important. Valuable performance data is obtained when it is possible to dismantle mechanisms and examine the condition of all components after the tests. This was particularly important for two ESA mechanisms subjected to seven-year real life tests, one having lead-lubricated bearings and the other oil-lubricated bearings. The ESTL experience in component examination and failure analysis, with advice on how to improve mechanism reliability, is reviewed. ESA

N86-27391# European Space Tribology Lab., Risley (England).
THERMAL VACUUM INCLINOMETRY: A TEST FACILITY FOR ANTENNA POINTING MECHANISMS **c14**
E. W. Roberts *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 261-265 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The development of a measurement and test facility for space antenna pointing mechanisms is described. The system allows measurements of high accuracy and resolution to be made on mechanisms operating under ambient or thermal vacuum conditions (-40 C to +80 C). The basis of the facility is a high precision tilt sensor which can be used in high vacuum. Data acquisition from such sensors is by means of an LSI/11-23 based computer which also allows data processing and programmed control over mechanism movements. In static measurements the system displays high accuracy (+ or - 0.001 deg) high resolution (0.0004 deg) and good repeatability (0.0005 deg). Examples of tests made possible by this measuring system are presented. ESA

N86-27392# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
THE OLYMPUS ANTENNA DEPLOYMENT SUBSYSTEM DESIGN AND TESTING
M. D. Death *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 267-272 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Satellite Antenna Deployment Subsystem design and engineering model testing is presented. The design, test philosophies, and their implications for the hardware are discussed. Functional, vibration and thermal vacuum test results are summarized and the hardware implications considered. The consequences of the engineering model test program and its implications for qualification and flight model testing are treated. ESA

N86-27393# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
RESULTS OF A 10 Nms REACTION WHEEL TEST PROGRAMME, INCLUDING TESTS ON A NYLON PORE LUBRICATION SYSTEM
G. J. Sturtivant *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 273-278 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The Olympus satellite 10 Nms reaction wheel test program philosophy and results are presented. The test program is designed to fully characterize the reaction wheel assembly and to verify that the unit is capable of surviving the launch and operating environments. The lubrication system theory and test program are discussed. A history of the testing and difficulties is also included, and the resulting design modifications are detailed. ESA

N86-27394# Centre National d'Etudes Spatiales, Toulouse (France).
MECHANISMS DEVELOPED IN THE FRENCH SPACE INDUSTRY **c37**
R. Salome and L. Petitjean *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 283-288 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Mechanisms developed for satellite projects such as SPOT, Giotto, TV.SAT, and TELEX-X are described. Solar Array Drives, antenna pointing mechanisms, and hinges for robot arms are presented. ESA

N86-27395# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
ARIANE RELEASE GEAR SYSTEM **c15**
P. McMahon *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 289-296 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

The Ariane release gear system consists of four arms used to support the vehicle during assembly and integration. Contained within each arm is a release mechanism used to restrain the vehicle during engine ignition and then, on command of a signal from the launch site computer, release the vehicle in a controlled manner over 200 ms so that its acceleration increases in a linear fashion. Once the vehicle rises 150 mm a retraction system is employed to withdraw the arms away from the flight path of the rising vehicle. The four release and four retraction mechanisms are operated hydraulically from a common power source. Similar pipe lengths are employed between the power unit and the release arms to ensure simultaneous operation of the mechanisms. ESA

N86-27396# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
ARIANE 3RD STAGE PRESSURE CONTROL VALVES **c15**
C. B. Taylor *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 297-303 (For primary document see N86-27353 18-18)

Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Cryogenic pressure control valves were designed, developed, and qualified for the third stage of the Ariane launch vehicle. Design drivers include accurate pressure control and operation under conditions of vibration, acceleration, and +30 to -223 deg C temperatures. The methods by which the required performance was achieved are presented together with typical test data. The development and qualification programs are reviewed. ESA

N86-27397# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

SPACE MECHANISMS DEVELOPMENT IN THE ESA TECHNOLOGICAL RESEARCH PROGRAM c37

D. Wyn-Roberts *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 305-310 (For primary document see N86-27353 18-18)

Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

Spacecraft components, control actuators, space operation mechanisms, instrument mechanisms, deployment mechanisms, and solar array mechanisms are described. Motors, wheels (including energy storage), docking and robotics mechanisms, and masts are discussed. ESA

N86-27398*# General Electric Co., Philadelphia, Pa. Space Systems Div.

SPACE STATION AUTOMATION STUDY: AUTOMATION REQUIREMENTS DERIVED FROM SPACE MANUFACTURING CONCEPTS,VOLUME 2 Final Report

27 Nov. 1984 125 p

(Contract NAS5-25182)

(NASA-CR-177862-Vol-2; NAS 1.26:177862-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 22B

Automation reuirements were developed for two manufacturing concepts: (1) Gallium Arsenide Electroepitaxial Crystal Production and Wafer Manufacturing Facility, and (2) Gallium Arsenide VLSI Microelectronics Chip Processing Facility. A functional overview of the ultimate design concept incoporating the two manufacturing facilities on the space station are provided. The concepts were selected to facilitate an in-depth analysis of manufacturing automation requirements in the form of process mechanization, teleoperation and robotics, sensors, and artificial intelligence. While the cost-effectiveness of these facilities was not analyzed, both appear entirely feasible for the year 2000 timeframe. B.G.

N86-27399*# General Electric Co., Philadelphia, Pa. Space Systems Div.

SPACE STATION AUTOMATION STUDY: AUTOMATION REQUIREMENTS DERIVED FROM SPACE MANUFACTURING CONCEPTS. VOLUME 1: EXECUTIVE SUMMARY Final Report

9 Jul. 1984 34 p

(Contract NAS5-25182)

(NASA-CR-177862-Vol-1; NAS 1.26:177862-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22B

The electroepitaxial process and the Very Large Scale Integration (VLSI) circuits (chips) facilities were chosen because each requires a very high degree of automation, and therefore involved extensive use of teleoperators, robotics, process mechanization, and artificial intelligence. Both cover a raw materials process and a sophisticated multi-step process and are therfore highly representative of the kinds of difficult operation, maintenance, and repair challenges which can be expected for any type of space manufacturing facility. Generic areas were identified which will require significant further study. The initial design will be based on terrestrial state-of-the-art hard automation. One hundred candidate missions were evaluated on the basis of automation portential and availability of meaning ful knowldege. The design requirements and unconstrained design concepts developed for the two missions are presented. B.G.

N86-27400*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.

DEVELOPMENT OF AN EMULATION-SIMULATION THERMAL CONTROL MODEL FOR SPACE STATION APPLICATION Semiannual Status Report

Gene T. Colwell and James G. Hartley 5 Jan. 1986 46 p

(Grant NAG1-551)

(NASA-CR-177298; NAS 1.26:177298) Avail: NTIS HC A03/MF A01 CSCL 22B

Analysis techniques to evaluate the effects of changing thermal loads and the methods utilized to control temperature distributions in the orbital space station are essential. Analysis techniques including a user-friendly computer program, were developed which should prove useful in thermal design and system analysis of the the space station. The program uses a data base and user input to compute costs, sizes, and power requirements for individual components and complete systems. User input consists of selecting mission parameters, selecting thermal acquisition configurations, transport systems and distances, and thermal rejection configurations. B.G.

N86-27401*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.

ADAPTIVE CONTROL OF LARGE SPACE STRUCTURES USING RECURSIVE LATTICE FILTERS Final Report

N. Sundararajan and Gene L. Goglia Dec. 1985 80 p

(Grant NAG1-429)

(NASA-CR-177270; NAS 1.26:177270) Avail: NTIS HC A05/MF A01 CSCL 22B

The use of recursive lattice filters for identification and adaptive control of large space structures is studied. Lattice filters were used to identify the structural dynamics model of the flexible structures. This identification model is then used for adaptive control. Before the identified model and control laws are integrated, the identified model is passed through a series of validation procedures and only when the model passes these validation procedures is control engaged. This type of validation scheme prevents instability when the overall loop is closed. Another important area of research, namely that of robust controller synthesis, was investigated using frequency domain multivariable controller synthesis methods. The method uses the Linear Quadratic Guassian/Loop Transfer Recovery (LQG/LTR) approach to ensure stability against unmodeled higher frequency modes and achieves the desired performance. E.R.

N86-27402*# RCA Astro-Electronics Div., Princeton, N. J.

COMMUNICATIONS PLATFORM PAYLOAD DEFINITION STUDY

H. W. Clopp, T. A. Hawkes, C. R. Bertles, B. A. Pontano (Communications Satellite Corp., Clarksburg, Md.), and T. Kao Washington, D.C. NASA Jul. 1986 245 p

(Contract NAS3-24236)

(NASA-CR-174986; NAS 1.26:174986) Avail: NTIS HC A11/MF A01 CSCL 22B

Large geostationary communications platforms were investigated in a number of studies since 1974 as a possible means to more effectively utilize the geostationary arc and electromagnetic spectrum and to reduce overall satellite communications system costs. The commercial feasibility of various communications platform payload concepts circa 1998 was addressed. Promising payload concepts were defined, recurring costs were estimated, and critical technologies needed to enable eventual commercialization were identified. Ten communications service aggregation scenarios describing potential groupings of service were developed for a range of conditions. Payload concepts were defined for four of these scenarios: (1) Land Mobile Satellite Service (LMSS) meets 100% of Contiguous United States (CONUS) plus Canada demand with a single platform; (2) Fixed Satellite Service (FSS) (trunking + Customer Premises Service (CPS)), meet 20% of CONUS demand;(3) FSS (trunking + CPS + video distribution), 10 to 13% of CONUS demand; and (4) FSS (20% of demand) + Inter Satellite Links (ISL) + Tracking and Data Relay Satellite System

(TDRSS)/Tracking and Data Acquisition System (TDAS) Data Distribution. Author

N86-27403*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
COMMUNICATION PLATFORM PAYLOAD DEFINITION (CPPD) STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report, Jun. 1984 - Jul. 1985
E. M. Hunter Mar. 1986 40 p
(Contract NAS3-24235)
(NASA-CR-174928; NAS 1.26:174928; WDL-TR-10631-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22B

This is Volume 1 (Executive Summary) of the Ford Aerospace & Communications Corporation Final Report for the Communication Platform Payload Definition (CPPD) Study program conducted for NASA Lewis Research Center under contract No. NAS3-24235. This report presents the results of the study effort leading to five potential platform payloads to service CONUS and WARC Region 2 traffic demand as projected to the year 2008. The report addresses establishing the data bases, developing service aggregation scenarios, selecting and developing 5 payload concepts, performing detailed definition of the 5 payloads, costing them, identifying critical technology, and finally comparing the payloads with each other and also with non-aggregated equivalent services. Author

N86-27404*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
COMMUNICATION PLATFORM PAYLOAD DEFINITION (CPPD) STUDY. VOLUME 2: TECHNICAL REPORT Final Report, Jun. 1984 - Jul. 1985
E. M. Hunter, T. Driggers, and R. Jorasch Mar. 1986 598 p
(Contract NAS3-24235)
(NASA-CR-174929; NAS 1.26:174929; WDL-TR-10632-Vol-2) Avail: NTIS HC A25/MF A01 CSCL 22B

This is Volume 2 (Technical Report) of the Ford Aerospace & Communications Corporation Final Report for the Communication Platform Payload Definition (CPPD) Study program conducted for NASA Lewis Research Center under contract No. NAS3-24235. This report presents the results of the study effort leading to five potential platform payloads to service CONUS and WARC Region 2 traffic demand as projected to the year 2008. The report addresses establishing the data bases, developing service aggregation scenarios, selecting and developing 5 payload concepts, performing detailed definition of the 5 payloads, costing them, identifying critical technology, and finally comparing the payloads with each other and also with non-aggregated equivalent services. Author

N86-27405*# Ford Aerospace and Communications Corp., Palo Alto, Calif.
COMMUNICATION PLATFORM PAYLOAD DEFINITION (CPPD) STUDY. VOLUME 3: ADDENDUM Final Report, Jun. 1984 - Jul. 1985
E. M. Hunter, T. Driggers, and R. Jorasch Mar. 1986 424 p
(Contract NAS3-24235)
(NASA-CR-174930; NAS 1.26:174930; WDL-TR-10633-Vol-3) Avail: NTIS HC A18/MF A01 CSCL 22B

This is Volume 3 (Addendum) of the Ford Aerospace & Communications Corporation Final Report for the Communication Platform Payload Definition (CPPD) Study Program conducted for NASA Lewis Research Center under contract No. NAS3-24235. This report presents the results of the study effort leading to five potential platform payloads to service CONUS and WARC Region 2 traffic demand as projected to the year 2008. The report addresses establishing the data bases, developing service aggregation scenarios, selecting and developing 5 payload concepts, performing detailed definition of the 5 payloads, costing them, identifying critical technology, and finally comparing the payloads with each other and also with non-aggregated equivalent services. Author

N86-27406*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
USERS GUIDE: STEADY-STATE AERODYNAMIC-LOADS PROGRAM FOR SHUTTLE TPS TILES
Patricia A. Kerr and Dennis H. Petley Jul. 1984 112 p
(NASA-TM-85724; NAS 1.15:85724) Avail: NTIS HC A06/MF A01 CSCL 22B

A user's guide for the computer program that calculates the steady-state aerodynamic loads on the Shuttle thermal-protection tiles is presented. The main element in the program is the MITAS-II, Martin Marietta Interactive Thermal Analysis System. The MITAS-II is used to calculate the mass flow in a nine-tile model designed to simulate conditions duing a Shuttle flight. The procedures used to execute the program using the MITAS-II software are described. A list of the necessry software and data files along with a brief description of their functions is given. The format of the data file containing the surface pressure data is specified. The interpolation techniques used to calculate the pressure profile over the tile matrix are briefly described. In addition, the output from a sample run is explained. The actual output and the procedure file used to execute the program at NASA Langley Research Center on a CDC CYBER-175 are provided in the appendices. Author

N86-27407*# RCA Astro-Electronics Div., Princeton, N. J.
COMMUNICATIONS PLATFORM PAYLOAD DEFINITION STUDY, EXECUTIVE SUMMARY
H. W. Clopp, T. A. Hawkes, C. R. Bertles, B. A. Pontano (Communications Satellite Corp., Washington, D.C.), and T. Kao Jul. 1986 34 p
(Contract NAS3-24236)
(NASA-CR-174985; NAS 1.26:174985) Avail: NTIS HC A03/MF A01 CSCL 22B

Large geostationary communications platforms have been investigated in a number of studies since 1974 as a possible means to more effectively utilize the geostationary orbital arc and electromagnetic spectrum and to reduce overall satellite communications system costs. This NASA Lewis sponsored study addresses the commercial feasibility of various communications platform payload concepts circa 1998. It defines promising payload concepts, estimates recurring costs and identifies critical technologies needed to permit eventual commercialization. Ten communications service aggregation scenarios describing potential groupings of services were developed for a range of conditions. Payload concepts were defined for four of these scenarios: (1) Land Mobile Satellite Service (LMSS), meet 100% of CONUS plus Canada demand with a single platform; (2) Fixed Satellite Service (FSS) (Trunking + Customer Premises Service (CPS), meet 20% of CONUS demands; (3) FSS (Trunking + video distribution), 10 to 13% of CONUS demand; and (4) FSS (20% of demand) + Inter Satellite Links (ISL) + TDRSS/TDAS Data Distribution. Author

N86-27408*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ADVANCING AUTOMATION AND ROBOTICS TECHNOLOGY FOR THE SPACE STATION AND FOR THE US ECONOMY Progress Report, Oct. 1985 - Mar. 1986
Mar. 1986 57 p
(NASA-TM-88785; NAS 1.15:88785; ATAC-PR-2) Avail: NTIS HC A04/MF A01 CSCL 22B

In April 1985, as required by Public Law 98-371, the NASA Advanced Technology Advisory Committee (ATAC) reported to Congress the results of its studies on advanced automation and robotics technology for use on the Space Station. This material was documented in the initial report (NASA Technical Memorandum 87566). A further requirement of the Law was that ATAC follow NASA's progress in this area and report to Congress semiannually. This report is the second in a series of progress updates and covers the period between October 4, 1985, and March 31, 1986. NASA has accepted the basic recommendations of ATAC for its Space Station efforts. ATAC and NASA agree that thrust of Congress is to build an advanced automation and robotics technology base that will support an evolutionary Space Station Program and serve as a highly visible stimulator effecting

the U.S. long-term economy. The progress report identifies the work of NASA and the Space Station study contractors, research in progress, and issues connected with the advancement of automation and robotics technology on the Space Station. Author

N86-27409*# National Aeronautics and Space Administration, Washington, D.C.
THE SUITABILITY OF VARIOUS SPACECRAFT FOR FUTURE SPACE APPLICATIONS MISSIONS
Charles W. Mathews, Ralph Bernstein (International Business Machines Corp., Palo Alto, Calif.), and Donald C. MacLellan (Massachusetts Inst. of Tech., Cambridge.) Jul. 1986 18 p
(NASA-TM-88986; NAS 1.15:88986) Avail: NTIS HC A02/MF A01 CSCL 22B

The Space Applications Advisory Committee (SAAC) of NASA's Advisory Council was asked by the Associate Administrator for Space Science and Applications to consider the most suitable future means for accomplishing space application missions. To comply with this request, SAAC formed a Task Force whose report is contained in this document. In their considerations, the Task Force looked into the suitability of likely future spacecraft options for supporting various types of application mission payloads. These options encompass a permanent manned space station, the Space Shuttle operating in a sortie mode, unmanned platforms that integrate a wide variety of instruments or other devices, and smaller free fliers that accommodate at most a few functions. The Task Force also recognized that the various elements could be combined to form a larger space infrastructure. This report summarizes the results obtained by the Task Force. It describes the approach utilized, the findings and their analysis, and the conclusions. Author

N86-27410# National Oceanic and Atmospheric Administration, Washington, D. C. Natl. Environ. Satellite Data and Inform. Service.
FEDERAL AGENCY SATELLITE REQUIREMENTS Final Report
D. Cotter and I. Wolzer Jul. 1985 160 p
(AD-A165071) Avail: NTIS HC A08/MF A01 CSCL 04/2

This report summarizes the requirements of Federal agencies for the data and services of NOAA's civil operational environmental satellites--both polar-orbiting and geostationary. The Federal agencies contributing to this document have described their current and planned use of the data and services provided by NOAA's environmental satellite and Landsat systems, as well as those provided by the systems of others. Agency plans for taking advantage of proposed future Earth-sensing space systems, domestic and foreign, are cited also. The report emphasizes requirements for direct and indirect support from NOAA's environmental satellite systems. In the direct case, the agencies process, interpret, or use NOAA's satellite data, products, or services as inputs to in-house activities. In the indirect case, NOAA provides the agencies with support products, such as weather forecasts, that depend on satellite operations to various degrees. This report focuses on the direct requirements served by the National Environmental Satellite Data, and Information Service (NESDIS). Described here are the satellite needs of the Department of Agriculture, the Army Corps of Engineers, the Department of Transportation (which includes the Federal Aviation Administration and the Coast Guard), the Agency for International Development, the Department of Defense, the Department of the Interior, and the National Aeronautics and Space Administration. Current data uses and future requirements are addressed. GRA

N86-27411# National Oceanic and Atmospheric Administration, Washington, D. C. Natl. Environ. Satellite Data and Inform. Service.
GOES (GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE)-NEXT OVERVIEW Final Report
A. Schwalb, D. Cotter, and J. Hussey Sep. 1985 76 p
(AD-A165080) Avail: NTIS HC A05/MF A01 CSCL 22/2

This report describes, in summary form, the current National Oceanic and Atmospheric Administration (NOAA) Geostationary Operational Environmental Satellite (GOES) system and the scientific rationale used to develop specifications for the next generation of satellites of this series. The payload instruments of the current satellites are reviewed in conjunction with the products prepared from their data outputs. The rationale used by the National Weather Service (NWS) in developing top-level requirements for GOES-Next stresses the projected use of data within the restructured NWS organization expected in the 1990's. NOAA-certified requirements used by the National Aeronautics and Space Administration (NASA) to develop the Request for Proposal, issued to industry in June 1984, are also provided. Finally, a brief description of the satellite system that will be built for launch in the 1990's is provided. This final section has been abstracted from the winning proposal submitted by Ford Aerospace and Communications Corporation and is a glimpse at what the future has in store for GOES. Author (GRA)

N86-27412# National Oceanic and Atmospheric Administration, Washington, D. C. Natl. Environ. Satellite Data and Inform. Service.
OPERATIONAL SATELLITE SUPPORT TO SCIENTIFIC PROGRAMS Final Report
H. W. Yates, D. J. Cotter, and G. Ohring Mar. 1985 57 p
(AD-A165081) Avail: NTIS HC A04/MF A01 CSCL 22/2

The role of operational environmental satellites in science programs undertaken to study the Earth system is examined. It centers on the satellite systems operated by the National Oceanic and Atmospheric Administration (NOAA). Other satellite systems are referenced as appropriate. NOAA's operational satellites are serving the research community extensively. Research programs such as climate studies, ocean dynamics investigations, and global vegetation surveys benefit from the special characteristics of operational satellites. Among these characteristics are routine global coverage in many spectral intervals; reliability, resulting from a commitment to continue the service; speed in data access because of real-time applications; repeatability of measurements because of matched, calibrated instruments; and data handling methods that provide output products in conventional, usable formats and with traceable histories. Author (GRA)

N86-27413# National Oceanic and Atmospheric Administration, Washington, D. C.
COMPARISON OF THE DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP) AND THE NOAA POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE (POES) PROGRAM
D. Cotter, A. Ramsey, E. Heacock, J. Bailey, and Q. Wilkes Oct. 1985 416 p
(AD-A165118) Avail: NTIS HC A18/MF A01 CSCL 22/2

This report offers technical comparison of the two United States operational space programs that are based on the capabilities of polar-orbiting environmental satellites. The U.S. Air Force manages and conducts the operations of the Defense Meteorological Satellite Program (DMSP); the National Oceanic and Atmospheric Administration has the same responsibilities with respect to the NOAA Polar-orbiting Operational Environmental Satellite (POES) program. The report examines the major missions and goals of the two programs, the management and operational procedures that they follow, and the support they extend to each other and to other Federal agencies. Detailed discussions are provided about the specifications and performance characteristics of the spacecraft, sensors, onboard systems, command and control systems, and communications systems employed by the two programs. An extensive relative analysis of the operation and uses of the DMSP and POES imaging and atmospheric sounding instruments is provided. Other sensors and systems are discussed, as is the joint agreement between DOD and NOAA for sharing their satellite data and data processing load. Nonmeteorological users of DMSP and POES data are described. The organization and content of the satellite data archive are presented. Near-future system improvements and longer-term mission requirements are also discussed. Author (GRA)

N86-27414# National Oceanic and Atmospheric Administration, Washington, D. C.
NOAA SATELLITE REQUIREMENTS FORECAST Final Report
D. Cotter, L. Fisher, D. Montgomery, T. Pyle, and F. Zbar May 1985 119 p
(AD-A165244) Avail: NTIS HC A06/MF A01 CSCL 22/2

Environmental satellites have been an essential component of NOAA's global observing system for 25 years. This report offers a projection of NOAA's requirements for satellite data and services covering the next 15 years. These requirements derive from the mission responsibilities of NOAA's public service and research agencies; the National Weather Service, the National Ocean Service, the National Marine Fisheries Service, and the Office of Oceanic and Atmospheric Research. The National Environmental Satellite, Data, and Information Service operates the Polar-orbiting Operational Environmental Satellite (POES) and Geostationary Operational Environmental Satellite (GOES) systems and provides data archive and distribution services to the public and private sectors. The satellite support needed to help meet their mission goals through the end of this century are presented as they have been identified by each agency. The requirements specified in this report will be a major factor in the long-range planning for NOAA's future satellite programs.
Author (GRA)

N86-27415# Kayser Threde G.m.b.H., Munich (West Germany). Inst. fuer Plasmaforschung.
ANTHRORACK PHASE A STUDY. VOLUME 3: EXECUTIVE SUMMARY Final Report
P. Rank, comp. and W. Bangert, comp. Paris ESA 1 Feb. 1985 192 p Prepared in cooperation with SNIAS, St. Medard-en-Jalles, France, Compagnie Industrielle Radioelectrique, Gals, Switzerland and Energy Research Laboratory
(Contract ESA-5916/84-F-FL(SC))
(AN-RP-0000-01B-KT-Vol-3; ESA-CR(P)-2111-Vol-3; ESA-86-96646) Avail: NTIS HC A09/MF A01

Technical concepts, mission scenarios, project planning, and mission assurance of Anthrorack, a Spacelab human physiology facility, are summarized.
ESA

N86-27320*# Thermo-Systems, Inc., Minneapolis, Minn.
GAS EJECTION SYSTEM OVERVIEW AND DESIGN ENHANCEMENTS
Pat Miller *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 185-190 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27323*# Thermo-Systems, Inc., Minneapolis, Minn.
STRUCTURAL INTEGRITY OF GAS EJECTION SYSTEM
Mark Cascia *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 231-236 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27328*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GLOMR SATELLITE PAYLOAD G-308
In its The 1985 Get Away Special Experimenter's Symposium May 1986 p 285-291 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27645*# Naples Univ. (Italy).
TETHERED CONSTELLATIONS, THEIR UTILIZATION AS MICROGRAVITY PLATFORMS AND RELEVANT FEATURES
Luigi G. Napolitano and Franco Bevilacqua (Aeritalia S.p.A., Torino (Italy).) *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 2 Jun. 1986 p 65-77 Previously announced in IAA as A85-13279 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

N86-27646*# Alabama Univ., Huntsville.
ARTIFICIAL OR VARIABLE GRAVITY ATTAINED BY TETHER SYSTEMS
Charles A. Lundquist *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 79-86 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

N86-27647*# Martin Marietta Corp., Denver, Colo.
TETHERED ORBITAL REFUELING STUDY
Dale A. Fester *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 89-123 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

N86-27648*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TETHERS AND GRAVITY IN SPACE
Paul A. Penzo *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 125-135 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

N86-27658*# Contraves Italiana, Rome.
COMLINK PROPOSAL FOR FUTURE MISSIONS OF TETHERED SATELLITE
Filippo Sciarrino *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 387-398 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

N86-27659*# Aeritalia S.p.A., Torino (Italy). Gruppo Sistemi Spaziali.
TETHERED ELEVATOR AND PLATFORMS AS SPACE STATION FACILITIES: SYSTEMS STUDIES AND DEMONSTRATIVE EXPERIMENTS
In NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 413-455 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

N86-27660*# California Univ., La Jolla. Space Inst.
ROLES FOR TETHERS ON AN EVOLVING SPACE STATION
Joseph A. CArroll *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 457-472 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N86-27385# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
INTEGRATED SENSOR AND ACTUATOR SYSTEM FOR FLEXIBLE SPACE STRUCTURE EXPERIMENTS
Th. Lange and H. Holzach *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 217-220 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N86-27416*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

ADVANCED ELECTRIC PROPULSION AND SPACE PLASMA CONTACTOR RESEARCH Annual Report, 1 Oct. 1984 - 1 Jan. 1986

Paul J. Wilbur Jan. 1986 151 p
(Grant NGR-06-002-112)
(NASA-CR-175119; NAS 1.26:175119) Avail: NTIS HC A08/MF A01 CSCL 21C

A series of experiments performed on an 8 cm dia. ring cusp magnetic field ion thruster are described. The results show the effects of anode and cathode position and size, ring cusp axial location and discharge chamber length on plasma ion energy cost and extracted ion fraction. Thruster performance is shown to be improved substantially when optimum values of these parameters are used. Investigations into the basic plasma phenomena associated with the process of plasma contacting are described. The results show the process of electron collection from a background plasma to a hollow cathode plasma contactor exhibits a higher impedance than the process of electron emission from the hollow cathode. The importance of having cold ions present to facilitate the plasma contacting process is shown. Results of experiments into the behavior of hollow cathodes operating at high interelectrode pressures (up to approx. 100 Torr) on nitrogen and ammonia are presented. They suggest that diffuse emission from the insert of a hollow cathode can be sustained at high interelectrode pressures if the cathode is made of non-conducting material and the cathode internal pressure is reduced by evacuating the cathode interior. A theoretical model of discharge chamber operation developed for inert gas thrusters is extended so it can be used to evaluste the performance of mercury ion thrusters. Predictions of the model are compared to experimental results obtained on two 30 cm dia. thrusters. Author

N86-27417*# Wyle Labs., Inc., Huntsville, Ala.
SIGNAL DETECTION TECHNIQUES FOR DIAGNOSTIC MONITORING OF SPACE SHUTTLE MAIN ENGINE TURBOMACHINERY Final Report

Thomas Coffin and Jen-Yi Jong Feb. 1986 178 p
(Contract NAS8-34961)
(NASA-CR-178851; NAS 1.26:178851; TR-66938-01) Avail: NTIS HC A09/MF A01 CSCL 21H

An investigation to develop, implement, and evaluate signal analysis techniques for the detection and classification of incipient mechanical failures in turbomachinery is reviewed. A brief description of the Space Shuttle Main Engine (SSME) test/measurement program is presented. Signal analysis techniques available to describe dynamic measurement characteristics are reviewed. Time domain and spectral methods are described, and statistical classification in terms of moments is discussed. Several of these waveform analysis techniques have been implemented on a computer and applied to dynamc signals. A laboratory evaluation of the methods with respect to signal detection capability is described. A unique coherence function (the hyper-coherence) was developed through the course of this investigation, which appears promising as a diagnostic tool. This technique and several other non-linear methods of signal analysis are presented and illustrated by application. Software for application of these techniques has been installed on the signal processing system at the NASA/MSFC Systems Dynamics Laboratory. Author

N86-27418*# Sverdrup Technology, Inc., Cleveland, Ohio.
CHARACTERIZATION OF REAL GAS PROPERTIES FOR SPACE SHUTTLE MAIN ENGINE FUEL TURBINE AND PERFORMANCE CALCULATIONS Final Report

Gary J. Harloff Jun. 1986 97 p
(Contract NAS3-24105)
(NASA-CR-175066; E-2938; NAS 1.26:175066) Avail: NTIS HC A05/MF A01 CSCL 21H

Real thermodynamic and transport properties of hydrogen, steam, the SSME mixture, and air are developed. The SSME mixture properties are needed for the analysis of the space shuttle main engine fuel turbine. The mixture conditions for the gases, except air, are presented graphically over a temperature range from 800 to 1200 K, and a pressure range from 1 to 500 atm. Air properties are given over a temperature range of 320 to 500 K, which are within the bounds of the thermodynamics programs used, in order to provide mixture data which is more easily checked (than H2/H2O). The real gas property variation of the SSME mixture is quantified. Polynomial expressions, needed for future computer analysis, for viscosity, Prandtl number, and thermal conductivity are given for the H2/H2O SSME fuel turbine mixture at a pressure of 305 atm over a range of temperatures from 950 to 1140 K. These conditions are representative of the SSME turbine operation. Performance calculations are presented for the space shuttle main engine (SSME) fuel turbine. The calculations use the air equivalent concept. Progress towards obtaining the capability to evaluate the performance of the SSME fuel turbine, with the H2/H2O mixture, is described. Author

N86-27419*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
IMPROVEMENT OF ION THRUSTER DESIGN Final Report

Raymon T. Carpenter 1986 139 p
(Grant NAG3-206)
(NASA-CR-177223; NAS 1.26:177223) Avail: NTIS HC A07/MF A01 CSCL 21C

Two types of measurements were performed on ion thrustors equipped with SmCo magnets in either ring cusp or line cusp arrangements. Langmuir probes were used to measure plasma potential, electron density, and electron temperture in all regions inside the thruster. Loss fluxes to various surfaces were determined by measuring the currents to foils attached to or imbedded in the surface. Data were obtained for several sets of discharge voltages and currents. The loss currents were determined from current vs voltage characteristics observed on a transistor curve tracer oscilloscope. Both ion and electron currents were measured to all parts of the walls and to all parts of the cathode assembly using collecting plates. These measurement were also made for various parameter sets. In line cusp configuration the plasma density is essentially as predicted by existing calculations. In the ring cusp arrangement the interior of the plasma contains an inhomogeneous and relatively large magnetic field so the geometry is decidely two-dimensional and the models of Self (1967) and of Kino and Sham (1966) do not agree. B.G.

N86-27420# Weather Squadron (2nd), Patrick AFB, Fla. Detachment 11.
THE ROCKET EXHAUST EFFLUENT DIFFUSION MODEL Final Report

Clint Bowan 3 Jul. 1985 19 p
(AD-A164963; Rept-2WS/CP-85/006) Avail: NTIS HC A02/MF A01 CSCL 20/4

Described are the purpose, historical development, program components, and output of NASA's Rocket Exhaust Effluent Diffusion Model (REEDM). GRA

N86-27421# Naval Postgraduate School, Monterey, Calif.
PARTICLE SIZING IN A SOLID-PROPELLANT ROCKET MOTOR USING SCATTERED LIGHT MEASUREMENTS M.S. Thesis

John S. Rosa Dec. 1985 90 p
(AD-A165017) Avail: NTIS HC A05/MF A01 CSCL 21/8

An experimental investigation was performed to determine, in situ, the change in mean particle size across the exhaust nozzle of a small metallized solid-propellant rocket motor. Light scattering profiles were recorded at both the exhaust and the entrance of the nozzle. The experiment method used provided excellent results within the exhaust. However, combustion light at the wavelength of the transmitted light hampered light scattering measurements within the motor. Particle size measurements were consistent with the sizes found in the collected exhaust products. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N86-27422# Naval Research Lab., Washington, D. C.
SECONDARY FREE RADIAL INTERMEDIATES IN THE SYNTHESIS OF 2-METHYL-6-NITROINDAZOLE Interim Report, Nov. 1984 - Nov. 1985
J. H. Boyer, M. D. Pace, P. Pagoria, T. P. Pillai, and D. Stec 10 Mar. 1986 14 p
(AD-A165042; NRL-MR-5736) Avail: NTIS HC A02/MF A01 CSCL 07/3

Four distinct free radical intermediates were detected by electron spin resonance (e.s.r) spectroscopy during the spontaneous conversion of an isomeric mixture of 2,4 and 3,4-dinitro-N,N-dimethylbenzylamine to 2-methyl-6-nitroindazole. These spectra include an iminoxyl radical, R-N=N-O. (not reproducible); a dimethylnitroxyl radical, (CH3)2NO. (reproducible); and two structurally unidentified radicals (also reproducible). Free radical intermediates were detected only when the reaction was started by nitrating 4-nitro-N,N-dimethylbenzylamine. No free radicals were detected when the reaction was started by mixing separately prepared 2,4 and 3,4-dinitro-N,N-dimethyl-benzylamine. (3,4-dinitro-N,N-dimethylbenzylamine alone does not convert to 2-methyl-6-nitroindazole). GRA

N86-27423# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICOCHEMICAL MECHANICS OF MATERIALS (SELECTED ARTICLES)
V. F. Sarabeyev, S. M. Perlin, G. K. Shreyber, V. N. Kestelman, and L. N. Magazinova 5 Mar. 1986 12 p Transl. into ENGLISH from Fiziko-Khimicheskaya Mekhanika Materialov (USSR), no. 4, Jul. - Aug. 1971 p 88-90
(AD-A165518; FTD-ID(RS)T-1273-85) Avail: NTIS HC A02/MF A01 CSCL 11/9

This report includes the following articles: (1) The problem of the Classification of Stresses in Reinforced Plastics - No clearly-defined classification of stresses arising in the area of reinforced plastics exists at the present time. These stresses have the most diverse types of names: internal, residual, initial, intrinsic, thermo-structural, structural, optical. When becoming familiar with the research done by investigator of different schools, it is difficult to know precisely which stresses they are addressing. It is expedient to make use of only two terms: transient and residual stresses. Stresses disappearing in a material, stock, or structure after elimination of the causes of their arising must be called transient stresses. Residual stresses are those which are maintained after the removal of the causes of their appearance. (2) Investigation of the Creep of a Polycarbonate in Corrosive Environments - The polycarbonate is one of the new polymeric materials promising for industry, but its physical and mechanical properties and its exploitation properties have not been sufficiently studied. Macrolon (West Germany) and Diflon K (USSR) polycarbonates are used in Soviet industry. We raised the problem of investigating the creep an the long-term stability of makrolon and Diflon k in corrosive environments. GRA

N86-27424# Lawrence Livermore National Lab., Calif.
SOME APPLICATIONS OF MICROANALYTICAL ELECTRON MICROSCOPY IN MATERIALS RESEARCH
G. Thomas Oct. 1985 36 p Presented at the 1st Conference and Exhibition on Instrumental Analysis, Beijing, China, 18 Nov. 1985
(Contract DE-AC03-76SF-00098)
(DE86-005214; LBL-20224; CONF-8511149-1) Avail: NTIS HC A03/MF A01

Electron microscopy has made extraordinary progress over the past 30 years and has become an indispensible tool for research in materials science. In this paper a review is given of some applications of microdiffraction and microanalysis in our current materials science research projects at the University of California, Berkeley. The following topics were discussed. (1) The problem of solute atom partitioning in steels; this includes the difficulties of measuring carbon contents and methods of utilizing diffraction, lattice imaging, energy dispersive X-ray (EDXS) and electron energy loss (EELS) spectroscopies and atom probe analysis will be illustrated. (2) Utilization of CBED and EDXS techniques in zirconia ceramics research. (3) Applications of CBED to the study of gamma Fe2O3 particles used in magnetic recording systems. (4) Applications of CBED and EDXS to rare earth permanent magnets. (5) Channelling enhanced microanalysis.DOE

N86-27321*# Swedish Space Corp., Stockholm.
AN ADVANCED MATERIAL SCIENCE PAYLOAD FOR GAS
R. Joensson, S. Wallin, and K. Loeth *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 191-217 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

24 COMPOSITE MATERIALS

Includes laminates.

N86-27425# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Structures and Materials Panel.
IMPACT DAMAGE TO COMPOSITE STRUCTURES
Feb. 1986 40 p
(AGARD-R-729; ISBN-92-835-1517-X) Avail: NTIS HC A03/MF A01

The impact of ballistic penetrators in fuel filled tanks generates high dynamic pressure loading. This damage process is generally referred to as hydraulic ram. Hydraulic ram in aircraft fuel tanks results in large damage of structural components, which in turn can lead to fuel loss or ingestion into the engines, fire and explosion. To determine the effect of hydraulic ram to an integral fuselage fuel tank with carbon/epoxy skin, a firing program was established. Plane carbon/epoxy plates, bolted to an impact box, were impacted with single cuboid fragments. Different shock-absorbing materials used to reduce hydraulic ram pressures on the impact plate, were investigated to prevent propagation of the shock wave. Multiple fragments were projected against the simulated fuel tank sections with carbon/epoxy skins and sandwich design at a hit density of 25 fragments per square meter. Author

N86-27426*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE CORRELATION OF LOW-VELOCITY IMPACT RESISTANCE OF GRAPHITE-FIBER-REINFORCED COMPOSITES WITH MATRIX PROPERTIES
Kenneth J. Bowles 1986 24 p Presented at the 8th Symposium on Composite Materials Testing and Design, Charleston, S. Car., 29 Apr. - 1 May 1986; sponsored by the American Society for Testing and Materials
(NASA-TM-87337; E-3084; NAS 1.15:87337) Avail: NTIS HC A02/MF A01 CSCL 11D

Summarized are basic studies that were conducted to correlate the impact resistance of graphite-fiber-reinforced composites with polymer matrix properties. Three crosslinked epoxy resins and a linear polysulfone were selected as composite matrices. As a group, these resins possess a significantly large range of mechanical properties. The mechanical properties of the resins and their respective composites were measured. Neat resin specimens and unidirectional and crossply composite specimens were impact tested with an instrumented dropweight tester. Impact resistances of the specimens were assessed on the basis of loading capability, energy absorption, and extent of damage. Author

N86-27427*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
FRACTURE SURFACE ANALYSIS IN COMPOSITE AND TITA-

NIUM BONDING Annual Report
T. A. DeVilbiss and J. P. Wightman Apr. 1986 14 p refs
(Grant NAG1-343)
(NASA-CR-177271; NAS 1.26:177271) Avail: NTIS HC A02/MF A01 CSCL 11D

Carbon fibers were obtained from several manufacturers. Surface treatments were performed on these fibers by anodization. The surfaces of these fibers were analyzed by X-ray photoelectron spectroscopy and wetting force measurement. The breaking strength of these fibers was measured at 2.5 cm length. It was seen that the surface treatments reduces the strength of the fibers. It was also seen that the Hercules fibers had a higher breaking strength than the Union Carbide fibers. Fiber critical length measurements showed no difference in critical lengths between AS-4 and AU-4 fibers embedded in polysulfone. However, the fiber lengths were much shorter for the surface treated fibers. This effect could be related to increased adhesion between fiber and matrix, or it could be due to the lower breaking strength of the surface treated fiber. Author

N86-27428*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF PARTIAL INTERLAMINAR BONDING ON IMPACT RESISTANCE AND LOADED-HOLE BEHAVIOR OF GRAPHITE/EPOXY QUASI-ISOTROPIC LAMINATES
Walter Illg Jul. 1986 48 p refs
(NASA-TM-87678; L-16088; NAS 1.15:87678) Avail: NTIS HC A03/MF A01 CSCL 11D

A partial-bonding interlaminar toughening concept was evaluated for resistance to impact and for behavior of a loaded hole. Perforated Mylar sheets were interleaved between all 24 plies of a graphite/epoxy quasi-isotropic lay-up. Specimens were impacted by aluminum spheres while under tensile or compressive loads. Impact-failure thresholds and residual strengths were obtained. Loaded-hole specimens were tested in three configurations that were critical in bearing, shear, or tension. Partial bonding reduced the tensile and compressive strengths of undamaged specimens by about one-third. For impact, partial bonding did not change the threshold for impact failure under tensile preload. However, under compressive preload, partial bonding caused serious degradation of impact resistance. Partial bonding reduced the maximum load-carrying capacity of all three types of loaded-hole specimens. Overall, partial bonding degraded both impact resistance and bearing strength of holes. Author

N86-27429*# Missouri Univ., Rolla. Dept. of Engineering Mechanics.
FINITE ELEMENT ANALYSIS OF END NOTCH FLEXURE SPECIMEN Final Report
S. Mall and N. K. Kochhar May 1986 21 p
(Grant NAG1-425)
(NASA-CR-178113; NAS 1.26:178113) Avail: NTIS HC A02/MF A01 CSCL 11D

A finite element analysis of the end notch flexure specimen for mode II interlaminar fracture toughness measurement was conducted. The effect of friction between the crack faces and large deflection on the evaluation of G sub IIc from this specimen were investigated. Results of this study are presented in this paper. Author

N86-27430# Army Materials and Mechanics Research Center, Watertown, Mass.
CAUSES OF DELAMINATION FAILURES OF KEVLAR/EPOXY LAMINATES USED IN HARDENED ARMY TACTICAL SHELTERS Final Report
William W. Houghton and Margaret E. Roylance Dec. 1985 28 p
(AD-A165507; MTL-TR-85-36) Avail: NTIS HC A03/MF A01 CSCL 13/13

A series of chemical, mechanical, and physical tests were performed on Kevlar/epoxy laminates to determine the cause of failure in a structure which had undergone extensive delamination during a simulated solar load test. The results of these tests indicated that improper fabrication procedures caused microcracking at the fiber matrix interface which made the material particularly susceptible to invasion by environmental moisture and subsequent delamination at elevated temperatures. The material was also found to have been undercured by approximately 30%. Acting on recommendations resulting from this study, the fabricator was able to eliminate the microcracking and significantly increase the degree of cure in the laminates. Preliminary measurements of the effect of moisture on the mechanical properties of the laminate suggested that design properties of the material should be determined at elevated temperature and humidity. Author (GRA)

N86-27500# Joint Publications Research Service, Arlington, Va.
ALUMINUM-GRAPHITE COMPOSITE MATERIALS STUDIED
Lida Liang *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 194-199 Transl. into ENGLISH from Dalian Gongxueyuan Xuebao (Dalian, China), v. 24, no. 3, Sep. 1985 p 109-112 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N86-27431* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPILLAGE DETECTOR FOR LIQUID CHROMATOGRAPHY SYSTEMS Patent
Michael J. Jarvis (Illinois Univ., Urbana) and Donald S. Fulton, inventors (to NASA) Issued 27 May 1986 12 p Filed 23 Mar. 1983 Supersedes N83-29325 (21 - 18, p 2890) Sponsored by NASA. Johnson Space Center
(NASA-Case-MSC-20206-1; US-Patent-4,591,838;
US-Patent-Appl-SN-478129; US-Patent-Class-340-605;
US-Patent-Class-200-61.05; US-Patent-Class-141-198) Avail: US Patent and Trademark Office CSCL 07D

A spillage detector device for use in conjunction with fractionation of liquid chromatography systems which includes a spillage recieving enclosure beneath the fractionation area is described. A sensing device having a plurality of electrodes of alternating polarity is mounted within the spillage recieving enclosure. Detection circuitry, responsive to conductivity between electrodes, is operatively connected to the sensing device. The detection circuitry feeds into the output circuitry. The output circuit has relaying and switching circuitry directed to a solenoid, an alarm system and a pump. The solenoid is connected to the pliable conduit of the chromatography system. The alarm system comprises an audio alarm and a visual signal. A 115-volt power system interconnected with the pump, the solenoid, the sensing device, and the detection and output circuitry. NASA

N86-27432*# Alabama Univ., Huntsville. Dept. of Chemistry.
OSTWALD RIPENING THEORY Final Report, 3 Oct. 1984 - 1 Jun. 1986
James K. Baird 1 Jun. 1986 84 p
(Contract NAS8-35986)
(NASA-CR-178860; NAS 1.26:178860; UAH-RR-514) Avail: NTIS HC A05/MF A01 CSCL 07D

The Ostwald-ripening theory is deduced and discussed starting from the fundamental principles such as Ising model concept, Mayer cluster expansion, Langer condensation point theory, Ginzburg-Landau free energy, Stillinger cutoff-pair potential, LSW-theory and MLSW-theory. Mathematical intricacies are reduced to an understanding version. Comparison of selected works, from 1949 to 1984, on solution of diffusion equation with and without sink/sources term(s) is presented. Kahlweit's 1980 work and Marqusee-Ross' 1954 work are more emphasized. Odijk and Lekkerkerker's

1985 work on rodlike macromolecules is introduced in order to simulate interested investigators. Author

N86-27433*# Alabama Univ., Huntsville. Dept. of Chemistry.
OSTWALD RIPENING THEORY Quarterly Report, 1 Apr. - 30 Jun. 1985
James K. Baird 1985 10 p
(Contract NAS8-35986)
(NASA-CR-178862; NAS 1.26:178862) Avail: NTIS HC A02/MF A01 CSCL 07D

An approximate analytical technique for extracting the concentration dependence of the interdiffusion coefficient was derived from diffusion measurements carried out with the diaphragm cell. The systematic error incurred in using the technique was estimated and found to be no greater than the random error ordinarily encountered in these experiments. Author

N86-27434*# California Univ., San Diego.
FLAME PROPAGATION AND EXTINCTION IN PARTICLE CLOUDS Final Technical Report, 2 Jan 1984 - 31 Aug. 1985
A. L. Berlad and N. D. Joshi Jan. 1986 7 p
(Grant NAG3-473)
(NASA-CR-177304; NAS 1.26:177304) Avail: NTIS HC A02/MF A01 CSCL 21B

Two phase flame propagation and extinction theory required to support the corresponding experiments planned for the space shuttle is being developed. Also being planned are specialized collaborative, experimental and theoretical NASA UCSD studies needed to support the ongoing definition of needed experimental hardware, experimental procedures, data acquisition philosophy, and other ground based support activities required to assure the success of space shuttle based experiments concerned with combustion of clouds of particulates at reduced gravitational conditions. The further development of relations delineating premixed particle cloud and premixed gaseous systems as well as burner stabilized and freely propagating flame systems is considered. E.R.

N86-27435# National Aeronautical Lab., Bangalore (India). Materials Science Div.
ELECTRONIC PROPERTIES OF CERIUM AND THE KINDO VOLUME-COLLAPSE MODEL
T. G. Ramesh and V. Shubha Mar. 1986 21 p
(NAL-TM-MT-8604) Avail: NTIS HC A02/MF A01

New data on the thermoelectric and resistivity behaviour of cerium across the isostructural gamma-alpha phase transition is reported. These high resolution data provide a more precise location of the critical point in the P-T plane. The recently developed Kondo volume collapse model has been highly successful in providing a semiquantitative description of the gamma-alpha transition. It is shown here that the anomalies in the transport properties can be explained within the same framework. Author

N86-27436# Naval Surface Weapons Center, Silver Spring, Md.
DYNAMIC COMPACTION OF POROUS BEDS Progress Report, May 1981 - Dec. 1984
H. W. Sandusky and T. P. Liddiard 26 Dec. 1985 53 p
(AD-A164883; NSWC/TR-83-246) Avail: NTIS HC A04/MF A01 CSCL 08/13

During the build-up of deflagration-to-detonation transition (DDT) in porous energetic materials, there is increasing dynamic compaction of the porous bed, which in turn affects the DDT build-up. To simulate the various pressures and pressurization rates that occur during DDT, a study of dynamic compaction was conducted with several different experimental arrangements, each designed to avoid direct ignition of the porous material by hot combustion products as in DDT. From those experiments, unreactive Hugoniot data were obtained for porous beds of three inert materials and a variety of energetic materials. GRA

N86-27437# California Univ., Los Angeles. Dept. of Chemistry and Biochemistry.
SUMMARY ABSTRACT: ANALYSIS OF CHEMICAL BONDING IN TiC, TiN, AND TiO USING SECOND-PRINCIPLES BAND STRUCTURES FROM PHOTOEMISSION DATA
Sehun Kim and R. S. Williams 28 Feb. 1986 3 p
(Contract N00014-83-K-0612)
(AD-A165053; TR-10) Avail: NTIS HC A02/MF A01 CSCL 20/8

This investigation was motivated in part by the observation that the empirical pseudopotential calculations of the TiC electronic structure produced valence electron densities that disagree severely with those obtained from first-principles calculations. The intent of this study was to see if the mixed-basis band structure interpolation scheme (MBBSIS) could be used to obtain reliable band structures and charge densities for more complex systems, such as TiC, TiN, and TiO. GRA

N86-27438# Battelle Columbus Labs., Ohio.
RETENTION KINETICS OF SOLID PARTICULATES ON SOLID SURFACES Special Publication, Jun. 1983 - Feb. 1984
Barton E. Dahneke Jan. 1986 42 p
(Contract DAAG29-81-D-0100; DA Proj. 1L1-62706-A-553)
(AD-A165130; CRDC-SP-84021) Avail: NTIS HC A03/MF A01 CSCL 13/11

When fiber filters are used in the aerosol filtration process, aerosol particles collide with the fibers and are captured on their surfaces. For the filtration process to be effective, the particles must be retained on the surface of the fiber. Although particle retention is recognized as an important aspect of filtration, the process has not been adequately addressed by theory and experiment, and no model of the process has been adequately incorporated into the principles of filter design. This report surveys the presently available information in the area of retention kinetics, which deals with particle/surface interactions and describes the conditions required for the retention or rebound of particles on or from surfaces. Knowledge gaps are identified in the areas of adhesion energy and force models, dynamic particle/surface interaction models, and experimental data. Recommendations are made for dynamic model development, coordinated experimental testing, and improvements in filter design. GRA

N86-27439# Sandia National Labs., Albuquerque, N. Mex.
FLOW AND MIXING STRUCTURES IN BLUFF-BODY STABILIZED GAS FLAMES
M. Namazian (Acurex Corp., Mountain View, Calif.), J. Kelly, R. W. Schefer, S. C. Johnston, and M. B. Long (Yale Univ., New Haven, Conn.) Jan. 1986 17 p Presented at the International Gas Research Conference, Toronto, Canada, 8 Sep. 1985 Prepared in cooperation with Sandia National Labs., Livermore, Calif.; Yale Univ., New Haven, Conn.
(Contract DE-AC04-76DR-00789)
(DE86-005648; SAND-85-8864; CONF-8509229-1) Avail: NTIS HC A02/MF A01

The mixing and combustion process has been studied in a bluff-body stabilized, nonpremixed flame using direct flame photography and planar flow visualization. The burner consisted of a central jet of CH4 and an outer coflowing air stream. Direct flame photography was used to study the effects of fuel and air flowrate on the global characteristics of the flame. Planar flow visualization techniques using Mie scattering from seed particles added to the fuel jet and Raman scattering from CH4 provided information on the interaction between turbulent mixing and combustion chemistry. The results show that the flow is highly three dimensional. Roll-up structures, which form randomly, are evident on the fuel and combustion air boundaries. Stabilization of the flame is dominated by large-scale turbulent mixing structures which are irregular and time-varying. DOE

N86-27440# Battelle Pacific Northwest Labs., Richland, Wash.
SUPERCRITICAL FLUID EXTRACTION OF PARTICULATE AND ADSORBENT MATERIALS Report, Feb. 1984 - Jan. 1985
B. W. Wright and R. D. Smith Mar. 1986 79 p Sponsored by EPA and DOE
(PB86-175999; EPA/600/4-86/017) Avail: NTIS HC A05/MF A01 CSCL 13B

A summary is presented of work on the extraction of semivolatiel organic materials (SVOCs), for example, polynuclear aromatic compounds, from various adsorbents and environmental matrices, using supercritical fluids (SCFs) as extractants. The results show that supercritical fluids are effective extractants for many SVOCs, and are often competitive with conventional Soxhlet extraction. Advantages of SCFs over conventional methods include higher extraction efficiency, more rapid extraction, and reduced decomposition of thermally labile compounds. GRA

N86-27441# Case Western Reserve Univ., Cleveland, Ohio.
RATE CONSTANTS FOR POLYMETHYLETACRYLATE DIFFUSION FLAME USING A SEMI-GLOBAL REACTION MODEL Final Report
N. A. Messaoudene and J. S. Tien Feb. 1986 59 p Sponsored by NSB, Gaithersburg, Md.
(PB86-171089; NBS/GCR-86/508) Avail: NTIS HC A04/MF A01 CSCL 21B

A numerical study of the combustion and extinction in the stagnation point boundary layer of a condensed fuel (PMMA) has been performed using a three-step semi-global reactions model. In the first step considered, fuel is oxidized to form carbon monoxide and water vapor. In the second, carbon monoxide is oxidized to form carbon dioxide, and in the reaction, carbon dioxide decomposes into carbon monoxide and oxygen, which is the reverse of the second reaction. The governing equations were transformed into a set of ordinary differential equations through a similarity variable. Fictitious unsteady terms were added to the ordinary differential equations and the resulting equations were solved numerically using an explicit scheme for the fictitious unsteady terms. Use has been made of Howard, et. al., kinetics constants for the forward reaction of CO (second reaction), and constants calculated from equilibrium considerations for the backward reaction (third reaction). Comparing the extinction results with experimental data, good agreement was found for B sub F = 4.43 x 10 to the 13th power cu ml/gmole.sec. and E sub F = 32000 cal/mole, which are respectively the preexponential factor and the activation energy for the rate of the first reaction.
Author (GRA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N86-27442 British Library Lending Div., Boston Spa (England).
DEVELOPMENTS AND TRENDS IN THE USE OF HIGH-TENSILE AND HIGH-STRENGTH MATERIALS
K. Kussmaul (Stuttgart Univ., West Germany) Jun. 1986 71 p Transl. into ENGLISH from "Fortschritte und Entwicklungstendenzen Beim Einsatz Hochzaeher und Hochfester Werkstoffe" Stuttgart, West Germany
(BLL-Risley-TR-5288-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Yield point is used to determine strength calculations in applied design principles in nuclear engineering. It was suggested that other toughness characteristics be used to determine strength calculations. Especially cracked components of non-austenitic steels with a predominately static load were examined. A calculation factor W can be introduced into the equations in the design code, which enables the wall thickness to be determined as a function of toughness if sufficient precise information is available on the mechanical, thermal, and corrosive loadings as well as the weldability. This is best done using a nomogram, in which the wall thickness factor is plotted as a function of impact toughness. Fractomechanical characteristics can be determined by means of crack resistance curves for crack initiation and resistance against further tearing and possibly even for load-controlled instability.
B.G.

N86-27443# National Aeronautical Lab., Bangalore (India). Materials Science Div.
STUDIES ON ELECTROLESS NICKEL BATHS
K. S. Rajam and S. R. Rajagopalan Jan. 1986 50 p
(NAL-TM-MT-8601) Avail: NTIS HC A03/MF A01

The feasibility of substituting ammonia in alkaline electroless nickel bath has been investigated. It is shown that ethylene diamine can be used in place of ammonia. However, such a bath has a narrow operating range. It is found that ethanolamines in general and triethanolamine in particular are useful substitutes for ammonia in citrate based alkaline electroless baths. Author

N86-27444*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.
THE EVOLUTION AND GROWTH OF Al2O3 SCALES ON BETA-NiAl Ph.D. Thesis. Final Report
Joseph K. Doychak May 1986 242 p
(Grant NAG3-498)
(NASA-CR-175097; NAS 1.26:175097) Avail: NTIS HC A11/MF A01 CSCL 11F

The formation and growth of Al2O3 scales on (beta)-NiAl were studied using electron microscopy and other analytical techniques to gain an understanding of the oxidation properties of (beta)-NiAl and of alumina-forming alloys, in general. The transient and mature stages of oxidation were studied as well as the transformation stage during which the oxide scale transforms from metastable Al2O3 phases to the thermodynamically stable alpha-Al2O3 phase. The transient oxidation stages were studied at 800 deg C and for short times at 1100C. At 800C, the scales consist predominantly of delta-Al2O3 which forms by cation vacancy ordering in the defective spinel lattice of gamma-Al2O3. At 1100C, a fast-growth morphology of theta-Al2O3 forms as a surface layer over delta-Al2O3. For both oxidation temperatures, the scales are often epitaxially oriented with respect to the metal. The transient scales grow by outward cation diffusion as evidenced by surface growth morphologies. The transformation to alpha-Al2O3 occurs within 1 hour at 1100C by a nucleation and radial growth process. The large volume decrease associated with the transformation results in a highly strained alpha-Al2O3 microstructure. A change in scale growth mechanism from outward cation to inward anion diffusion allows transient surface morphologies to be smoothed by surface diffusion. The mature stage of oxidation involves the growth of an alpha-Al2O3 scale having the lacey morphology formed as a result of the gamma yields alpha transformation. Growth of the scale occurs by counterdiffusion along grain boundaries resulting in ridges formed by impingement of alpha-Al2O3 nuclei during the transformation stage. Also scale growth occurs by inward oxygen diffusion through healed cracks; the cracks result from transformation stresses. The measured growth rates of scales having the lacey morphology are an order of magnitude less than fine-grained alpha-Al2O3 scales. Metal orientations were found to have a large effect on oxide morphologies during all stages of oxidation. Author

N86-27445# Argonne National Lab., Ill.
THIRD ANNUAL REVIEW OF MATERIALS RESEARCH CONFERENCE. CHICAGO SECION OF TMS-AIME, ASBTRACTS
1985 35 p Conference held at Argonne, Ill., 12 Sep. 1985
(Contract W-31-109-eng-38)
(DE86-001407; CONF-850935-Absts) Avail: NTIS HC A03/MF A01

Abstracts of 27 papers presented in five sessions are given. Among the topics covered are the following: high-temperature high strength alloys, phase tranformations in metallic systems, electronic materials, oxide ceramics, and a poster session. DOE

N86-27446# Oak Ridge National Lab., Tenn.
HOT CORROSION OF CHROMIUM IN (LI/SUB 0.62/K/SUB 0.38) SUB 2 CO SUB 3 AT 650 DEG C
H. S. Hsu 1985 28 p Presented at the Corrosion 86, Houston, Tex., 17 Mar. 1986
(Contract DE-AC05-84OR-21400)
(DE86-003091; CONF-860304-2) Avail: NTIS HC A03/MF A01

The hot corrosion of metallic chromium was studied in (Li(sub 0.62)K(sub 0.38))CO carbonate salt at 650 C under prototypical molten carbonate fuel cell environments. With the aid of phase stability diagrams of the Cr-Li-K-C-O system, the corrosion kinetics and scale morphologies were examined. The corrosion process in oxidizing atmospheres was divided into three distinct phases: (1) the formation of liquid corrosion product, chromate, from the reaction of carbonate and chromium, (2) the formation of nonprotective Cr O scale under the liquid corrosion product, and (3) localized hot corrosion in the Cr O scale due to the dry-out of the liquid corrosion product. The corrosion behavior in the oxidizing environment is primarily dependent on the oxygen concentration. Thus, the catastrophic corrosion of chromium with carbonate deposit can be alleviated by lowering the oxygen partial pressure in the gas phase. Very little corrosion was observed when chromium with a carbonate deposit was reached under reducing gas environments. This low corrosion rate of chromium was the result of the scarcity of oxygen in the reducing gas atmosphere. DOE

N86-27447# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
CORROSION OF SELECTED ALLOYS IN EUTECTIC LITHIUM-SODIUM-POTASSIUM CARBONATE AT 900C
R. T. Coyle, T. M. Thomas, and P. Schissel Jan. 1986 26 p
(Contract DE-AC02-83CH-10093)
(DE86-004417; SERI/PR-255-2561) Avail: NTIS HC A03/MF A01

There is an ongoing interest at the US Department of Energy in using molten salts as high temperature sensible heat storage media in advanced solar thermal systems. In this report, the compatibility of selected alloys in eutectic lithium-sodium-potassium carbonate, the salt to be used in the near-term engineering experiments, has been evaluated at 900C. Several combinations of oxidation potential and acidity in the salt were used in the experiments. It was found that the extent of corrosion was dramatically lower for experiments conducted at high oxygen potential compared to experiments at low oxygen potential. For Inconel 600, Hastelloy N, and nickel the results indicated that corrosion rates substantially below 1 mm/year/side might reasonably be expected and that a reevaluation of alloys exhibiting poor corrosion resistance under low oxygen potential would be advisable. DOE

N86-27448# Sandia National Labs., Albuquerque, N. Mex.
CONVECTION SIMULATION IN METAL SOLIDIFICATION
L. A. Bertram and F. J. Zanner 1985 10 p Presented at the American Society of Mechanical Engineers Winter Annual Meeting, Miami, Fla., 17 Nov. 1985
(Contract DE-AC04-76DP-00789)
(DE86-004605; SAND-85-0702C; CONF-851125-19) Avail: NTIS HC A02/MF A01

In casting and welding of metal alloys, segregation of alloy components on a macroscale can defeat the purposes for which the alloy was chosen and prevent correction by heat treatment. Convection is, of course, a very powerful transporter of molten metal over finite distances during solidification. Mechanisms by which convection can be driven include shrinkage induced pressure gradients, thermal buoyancy, magnetohydrodynamic pumping by electrical currents, and buoyancy due to compositional differences imposed by the alloy's equilibrium phase diagram. The experimental and numerical techniques by which these issues have been studied, including high-speed movies and computer animation, will be described, primarily in the context of the vacuum consumable arc remelting process. DOE

N86-27449# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
ENVIRONMENTAL FACTORS AFFECTING THE CORROSION OF GALVANIZED STEEL
F. H. Haynie Apr. 1986 19 p
(PB86-174075; EPA-600/D-86-061) Avail: NTIS HC A02/MF A01 CSCL 11F

Galvanized steel samples were exposed for periods of up to 30 months at nine air monitoring sites in the St. Louis, Missouri area. Climatic and air quality data were recorded during the exposure periods and were subjected to a rigorous evaluation to eliminate recording errors and to estimate missing values. Weight loss was used as the measure of zinc corrosion on the galvanized steel. Corrosion rate was evaluated with respect to fluxes of pollutants (sulfur oxides, nitrogen oxides, oxidants, and particles) to the galvanized steel during both wet and dry periods, temperature, and amount of rainfall at Lambert field (airport). Different definitions of when the galvanized steel was wet were evaluated to determine the most likely critical relative humidity. A theoretical model of film buildup and dissolution was developed to explain how factors affect corrosion rates. Nonlinear and linear multiple regression techniques were used to determine the statistical significance of each factor. GRA

N86-27305*# Purdue Univ., West Lafayette, Ind.
DESIGN OF AN EXPERIMENT FOR THE PRODUCTION OF A FOAMED TIN SAMPLE
Eric Wernimont *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 57-63 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N86-27450* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SULFONE-ESTER POLYMERS CONTAINING PENDENT ETHYNL GROUPS Patent
Paul M. Hergenrother and Brian J. Jensen, inventors (to NASA) Issued 6 May 1986 8 p Filed 23 May 1984 Supersedes N84-28987 (22 - 19, p 2996) Sponsored by NASA. Langley Research Center
(NASA-Case-LAR-13316-1; US-Patent-4,587,312; US-Patent-Appl-SN-613139; US-Patent-Class-525-535; US-Patent-Class-260-544P; US-Patent-Class-525-534; US-Patent-Class-526-285; US-Patent-Class-528-171; US-Patent-Class-528-174; US-Patent-Class-528-176) Avail: US Patent and Trademark Office CSCL 11B

Sulfone ester polymers containing pendent ethynyl groups and a direct and multistep process for their preparation are disclosed. The process involves the conversion of a pendent bromo group to the ethynyl group while the direct route involves reacting hydroxy-terminated sulfone oligomer or polymers with a stoichiometric amount of 5(4-ethynyl phenoxy)isophthaloyl chloride. The 5(4-ethynyl phenoxy)isophthaloyl chloride synthesis procedures are also disclosed.
Official Gazette of the U.S. Patent and Trademark Office

N86-27451* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TOUGHENING REINFORCED EPOXY COMPOSITES WITH BROMINATED POLYMERIC ADDITIVES Patent
Zohar Nir, Inventor (to NASA) (National Academy of Sciences - National Research Council, Washington, D. C.) and William J. Gilwee, Jr., Inventor (to NASA) Issued 15 Aug. 1985 13 p
(NASA-Case-ARC-11427-2; US-Patent-4,588,778; US-Patent-Appl-SN-765-980; US-Patent-Class-525-115; US-Patent-Class-525-119; US-Patent-Class-525-122; US-Patent-Class-525-108; US-Patent-Class-523-434; US-Patent-Class-523-445; US-Patent-Class-523-461) Avail: US Patent and Trademark Office CSCL 11B

Cured polyfunctional epoxy resins including tris(hydroxyphenyl) methane triglycidyl ether are toughened by addition of polybrominated polymeric additives having an EE below 1500 to the pre-cure composition. Carboxy-terminated butadiene-acrylonitrile rubber is

optionally present in the pre-cure mixture as such or as a pre-formed copolymer with other reactants. Reinforced composites, particularly carbon-reinforced composites, of these resins are disclosed and shown to have improved toughness.
Official Gazette of the U.S. Patent and Trademark Office

N86-27452*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERIZATION OF THE TRIBOLOGICAL COATING COMPOSITION 77 wt % CaF2 - 23 wt % Li F FUSED TO IN-750 ALLOY
Daniel L. Deadmore and Harold E. Sliney Jun. 1986 13 p
(NASA-TM-87342; E-3091; NAS 1.15:87342) Avail: NTIS HC A02/MF A01 CSCL 11B

A coating composed of 77 wt % CaF2 - 23 wt % LiF fused on IN-750 nickel-based alloy was studied using SEM, XRD, EDX, and optical microscopic methods. The surfaces examined were the as-fused coating with no subsequent treatment, the coating after ultrasonic cleaning in water, and the uncoated polished and etched metal. It was found that the coating reacts during fusion with Ti and Nb rich inclusions in the alloy. Numerous small rectangular crystallites of Ca(Ti,Nb) oxide are formed beneath an overlay of fused fluoride composition. These crystallines are stubby and appear to be embedded in the metal substrate surface. It is known from previous studies that this coating-alloy system has good tribological properties in extreme conditions, such as liquid fluorine. It has been concluded from the present study that the short firmly embedded crystalline protuberances contribute to the coating adherence and thereby to enhanced coating wear life.
Author

N86-27453*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADHESIVE EVALUATION OF THIN FILMS OF LARC-TPI AND LARC-TPI WITH 5 MOL % ODA
Donald J. Progar Jun. 1986 30 p
(NASA-TM-87738; NAS 1.15:87738) Avail: NTIS HC A03/MF A01 CSCL 11A

A commercially available LARC-TPI film and an experimentally prepared film of LARC-TPI with 5 mol % of 4,4'-oxydianiline (ODA), designated as LARC-TPI/ODA in the report, supplied by Mitsui Toatsu Chemicals, Incorporated (MTCI), Japan, were evaluated as thermoplastic adhesive films for bonding Ti-6Al-4V. The LARC-TPI/ODA had been shown by MTCI to possess more flow than thermoplastic LARC-TPI and was, therefore, evaluated and compared to the LARC-TPI. Lap shear strength was used to evaluate the materials as adhesives. They were characterized after fracture by determining the glass transition temperature, Tg. The mode of failure was also reported. Thermal exposure at 204C for 500 and 1000 hrs and a 72-hour water-boil were conducted on lap shear specimens prepared with the two adhesive films. Lap shear tests were conducted at RT, 177C, 204C, and 232C before and after exposures.
Author

N86-27454# Cornell Univ., Ithaca, N.Y.
METHACRYLAMIDE COPOLYMER RESISTS FOR ELECTRON BEAM LITHOGRAPHY
Y. M. N. Namaste, S. K. Obendorf, and R. Rodriguez 28 Feb. 1986 12 p
(Contract N00014-85-K-0474)
(AD-A165023; TR-2) Avail: NTIS HC A02/MF A01 CSCL 11/9

Polymethacrylamide (PMAAm) and copolymers of MAAm with methyl methacrylate were synthesized and evaluated for their applicability to electron beam lithography. The sensitivity of PMAAm has previously been reported as less than 1 microcurie/sq cm, with thermal stability at temperatures up to 330 C. Despite these claims, further lithographic evaluation of this resist system is apparently absent from the literature. This research was conducted to further investigate the lithographic performance of these resists and to determine their sensitivity using current definitions. Using PMAAm homopolymer with a 15 minute prebake at 200 C, the lithographic results were much poorer than expected. Patterns exposed to doses of 10 microcuries/sq cm or lower could not be developed using water was the developing solvent. Forced developing with Na2SiO3 solution (pH = 10) developed lower doses than water, but much greater thinning as observed. An unexposed thinning of 10% occurred when developing exposures of 15 microcuries/sq cm with water, and 40 microcuires/sq cm with Na2SiO3 solution (20 KV). Swelling of the unexposed polymer and some adhesion problems were observed. Because of the problems encountered with the PMAAm homopolymer during lithography, a series of MMA-MAAm copolymers were synthesized and evaluated as potential resists. These copolymers eliminated the problems of swelling and poor solubility of the homopolymer, but sensitivity enhancement over that of PMMA was minimal. GRA

N86-27455# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CREEP OF THERMOPLASTICS IN AIR AND PHYSIOLOGICAL SOLUTION
G. I. Roitberg, V. N. Kestelman, and R. Z. Rakhimov 14 Feb. 1986 9 p Transl. into ENGLISH from Fiziko-Khimicheskaya Mekhanika Materialov (USSR), no. 5, 1972 p 81-84
(AD-A165030; FTD-ID(RS)T-1272-85) Avail: NTIS HC A02/MF A01 CSCL 11/9

Creep of polymeric materials has been studied mainly under conditions of static monoaxial tension. We have now established the existence of elastic, resilient-elastic (nonsteady-state) and viscous (steady-state) components of total creep. In this case, the full deformation under constant tensile load and at constant temperature, as well as the duration of load, are interrelated. We studied the creep of polymers under normal conditions in air and in a liquid medium - a physiological solution (0.9% NaCl solution in distilled water) under static bending and pressure. The subjects of the study were polyamide - 12 (P-12), a copolymer of trioxane with dioxalene (STD), fluorinated polymethyl methacrylate (PM-MAF), and molding polyethylene terephtalate (PETF). GRA

N86-27456# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
THE AXIAL COMPRESSIVE STRENGTH OF HIGH PERFORMANCE POLYMER FIBERS Interim Report, Mar. 1982 - Dec. 1984
S. J. DeTeresa Mar. 1985 212 p
(Contract F33615-82-C-5068)
(AD-A165065; AFWAL-TR-85-4013) Avail: NTIS HC A10/MF A01 CSCL 11/9

An experimental and theoretical study of the axial compressive strengths of high performance polymer fibers is undertaken. Compressive failure of these fibers manifests itself as kink band formation. Techniques permitting the application of small, measurable axial compressive strains to initiate kink banding in fine fibers are introduced. Tensile tests of compressively kinked poly(p-phenylene terephthalamide) (PPTA) fibers reveal only a 10% loss in tensile strength after application of compressive strains much greater than the critical strain required for kink band initiation. The concepts of compressive failure due to elastic microbuckling instabilities in axially compressed extended-chain polymers is proposed. Highly oriented polymer fibers are treated as a laterally interacting collection of fully extended chains. The critical stress required to buckle this collection of chains is calculated to be equal to the minimum longitudinal shear modulus of the fiber. This critical compressive strength is used as a prediction of the limiting value of fiber compressive strength. An excellent linear correlation between axial compressive strength and torsion modulus is measured for four extended-chain polymer fibers and for a graphite fiber. These fibers exhibit compressive strengths equal to approximately one-third of their respective torsion moduli. The relationship between torsion strains and axial normal strains in high performance polymer fibers is also investigated. GRA

N86-27457# Department of the Navy, Washington, D. C.
NONSKID COATING FORMULATIONS Patent Application
Larry W. Kraft and Robert F. Brady, inventors (to Navy) Filed 22 Jan. 1986 15 p
(AD-D012186; US-Patent-Appl-SN-621308) Avail: NTIS

HC A02/MF A01 CSCL 01/5

It is an object of the present invention to provide improved nonskid coating formulations having enhanced impact resistance and resistance to sliding movement thereon by aircraft or other equipment. It is a further object of the invention to provide nonskid coatings which will maintain their adhesion to primed steel after severe impact and thus eliminate the hazards caused by dislodged fragments. Yet another object of the invention is to provide nonskid coatings which are resistant to wear and which provide resistance to sliding throughout their service life by virtue of their coarse textured surface. The nonskid coating formulations of the present invention are comprised of two or more components that contain specified ingredients in specified amounts. The nonskid coating formulation is comprised of the following ingredients, by weight, 3 to 8% amine resins, 7 to 13% epoxy resins, 17 to 22% pigments, fillers, and thickeners, 10 to 20% solvents and 39 to 56% aggregates. GRA

N86-27458# Sandia National Labs., Albuquerque, N. Mex.
MECHANISTIC STUDIES OF POLYSILANE SYNTHESIS BY REDUCTIVE COUPLING OF DICHLOROSILANES
J. M. Zeigler 1985 12 p Presented at the Symposium on Novem Polymerization Mechanisms and Methods, New York, N.Y., 13 Apr. 1985
(Contract DE-AC04-76DP-00789)
(DE86-003716; SAND-85-2538C; CONF-8504190-1) Avail: NTIS HC A02/MF A01

For most applications, the oligomer fraction is of little or no value, so it is desirable to shift the course of the reaction to production of as much linear polymer as possible at the expense of the oligomers. For many applications, these low molecular weight polymers are adequate, but for high precision applications, particularly microlithographic ones, low polydispersity materials with molecular weights above the critical molecular weight for chain entanglement at about 30,000 daltons are needed. Studies of the mechanism of the Na-mediated coupling of dichlorosilanes were carried out. These studies provide a greater understanding of the reaction and lead to improvements in methods which give polysilanes in higher yields, higher molecular weights, and lower polydispersities than previously obtainable. DOE

N86-27459# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
SHIELDING EFFECTIVENESS MEASUREMENTS OF PLASTICS
J. W. Adams and E. J. Vanzura Jan. 1986 33 p
(PB86-183605; NBSIR-85/3035) Avail: NTIS HC A03/MF A01 CSCL 11I

Measurement of shielding effectiveness (SE) of plastic materials may give serious problems due to the insulating nature of many plastics. A method of making these measurements using a flanged coaxial holder overcomes these limitations. GRA

N86-27376# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Technische Physik.
THE PERFORMANCE OF UNBONDED MoS2 FOR SPACE APPLICATIONS
V. Buck *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 155-159 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27377# Centre Suisse de Documentation dans le Domaine de la Microtechnique, Neuchatel. Dept. de Recherche et Developpement.
COATINGS AGAINST FRETTING
M. Maillat and H. E. Hintermann *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 161-166 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27379# Societe Nationale Industrielle Aerospatiale, Cannes (France).
USE OF MoS2 APPLIED BY PHYSICAL VAPOR DEPOSITION (PVD) ON SPACE MECHANISMS
J. F. Patin, M. Maillat (Centre Suisse de Documentation dans le Domaine de la Microtechnique, Neuchatel.), and H. E. Hintermann *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 173-176 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27469# General Dynamics Corp., Groton, Conn. Electric Boat Div.
BEHAVIOR OF ELASTOMERIC MATERIALS UNDER DYNAMIC LOADS, PART 4 Monthly Report
C. A. Caseiro *In* Shock and Vibration Information Center The Shock and Vibration Digest, Volume 18, No. 1 Jan. 1986 p 3-6 (For primary document see N86-27468 18-31)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N86-27460*# Santa Clara Univ., Calif. Dept. of Mechanical Engineering Research.
RESEARCH AND DEVELOPMENT OF NEAT ALCOHOL FUEL USAGE IN AUTOMOBILES
R. K. Pefley, L. Browning, S. Espanola, B. Pullman, R. Gururangan, and N. Saito Jun. 1984 147 p
(Grant NAG3-143)
(NASA-CR-174813; DOE/NASA/0143-1; NAS 1.26:174813; DOE/NBB-0067; ME84-1) Avail: NTIS HC A07/MF A01 CSCL 21D

The study is an extension of previous work. Its topical coverage ranges from research in the forms of experimental operation of engines in cold chambers and a photochemical smog chamber with allied computer modeling of the thermofluid mechanics of cold engine starting and photochemical smog through engine corrosion and wear studies, to vehicle operation, which includes a description of the engineering development of after-market conversion kits to change Ford Pinto vehicles from gasoline to alcohol. Although further research is recommended, evidence presented contributes positively to the view that it is feasible to operate neat alcohol fleets in the range of 1000-10,000 vehicles, without major operational difficulties and without exacerbating the environmental, health and safety risks associated with petroleum fuels. Author

N86-27461# Monsanto Co., Dayton, Ohio.
PROPERTIES OF AIRCRAFT FUELS AND RELATED MATERIALS Final Report, 15 Feb. 1982 - 31 Jan. 1985
D. S. Duvall, A. D. Snyder, J. Henry, D. J. Lewis, and F. N. Hodgson Aug. 1985 162 p
(Contract F33615-81-C-2035)
(AD-A164532; AFWAL-TR-85-2049) Avail: NTIS HC A08/MF A01 CSCL 21/4

Fuel tests, analyses, and analytical method development were conducted on a number of fuels of an experimental nature in conjuction with ongoing Air Force programs for studying fuel combustion behavior, turbine engine design, and other fuel related technologies. Fuels from conventional and alternate sources were studied, as were fuels of the high density missile propellant type. A wide variety of both physical and chemical properties of the

fuels were measured and are tabulated. Studies conducted to aid in the solution of operational problems are also reported. GRA

N86-27462# University of Southeastern Massachusetts, North Dartmouth.
QUANTITATIVE DETERMINATION OF CORROSION INHIBITOR LEVELS IN JET FUELS BY HPLC Final Report, 18 Jan. - 30 Sep. 1985
Margaret A. Wechter 6 Jan. 1986 31 p
(Contract N00014-85-M-0248)
(AD-A165220) Avail: NTIS HC A03/MF A01 CSCL 21/4

Corrosion inhibitors are mandatory additives which are added to Navy Jet fuels to reduce corrosion of transfer lines and storage tanks. In addition, they are known to enhance lubricity properties of hydro-treated fuels. It is known that, as fuels pass through transfer lines or are stored, the level of corrosion inhibitor present decreases and with this decrease there is a corresponding decrease in both the corrosion protection and the lubricity characteristics of the fuel. Since there are potentially deleterious effects resulting from a decrease in corrosion inhibitor concentrations, a method of quantifying their concentrations was desired in order to be able to make appropriate after market adjustments to fuels. Thus, the ultimate goal of this project was to develop an analytical method to quantitaively determine the amount of corrosion inhibitor present in fuel samples. A secondary goal was to gain more specific experimental evidence regarding the fate of the inhibitors. A method which efficiently extracts nine of the military approved commercial corrosion inhibitors from aircraft turbine fuels and qualitatively and quantitatively determines them by gel permeation chromatography is described. Additive concentration for quantitation ranges between 1 and 35 ppm (V/V). In addition the fate of the corrosion inhibitors at these concentrations in fuel was examined in the presence of steel surfaces, fresh water and sea water. GRA

N86-27463# Brookhaven National Lab., Upton, N. Y.
OVERVIEW OF US CONTRIBUTIONS TO IEA HYDROGEN TECHNOLOGY TASK 4 ELECTROLYTIC HYDROGEN PRODUCTION
A. Mezzina Jun. 1985 6 p Presented at the 4th IEA Task Workshop on Electrolytic Hydrogen Production, Julich, West Germany, 14 Jul. 1985
(Contract DE-AC02-76CH-00016)
(DE86-000026; BNL-36755; CONF-850799-3) Avail: NTIS HC A02/MF A01

US contributions to electrolytic hydrogen production technology research derive largely from the US Department of Energy Chemical/Hydrogen Energy Storage Systems Program. The programmatic rationale, goals and focus, which reflect current US R and D policy and perceptions, are discussed as they influence the substance and pace of the R and D program in Hydrogen Technology. Contributions and future prospects are discussed briefly. DOE

N86-27464# Lawrence Livermore National Lab., Calif.
PEX ENERGETIC LIQUID CARRIERS: ATTEMPTS TO CRYSTALLIZE
K. Scribner and P. Crawford Jun. 1985 17 p
(Contract W-7405-eng-48)
(DE86-003539; UCID-20469) Avail: NTIS HC A02/MF A01

We are developing a Paste Extrudable Explosive (PEX) that can be transferred from a storage location to the point of use by pressure extrusion. We must be capable of making the transfer under all stockpile to target sequence (STS) conditions. The requirements put severe constraints on the liquid carrier portion of the PEX: it must be compatible with the crystalline explosive, it must be an energy source so that the total PEX energy/density is useful, and it must not freeze. The effective low temperature requirement is -35C. We will use a mixture of liquids, all completely soluble in the mixture through the temperature range of interest. With negligible driving force to organize groups of molecules of a particular type, crystallization does not appear. We are thoroughly convinced that we have two such liquid mixtures. This report describes the thermal testing of various liquid and PEX mixtures that convinced us crystallization would not occur. DOE

N86-27465# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
MULTISTAGE METAL HYDRIDE COMPRESSOR
L. K. Heung 1986 14 p Presented at the Solid Storage Science and Engineering Meeting, Los Alamos, N. Mex., 12 Mar. 1986
(Contract DE-AC09-76SR-00001)
(DE86-001965; DP-MS-85-83; CONF-860345-1) Avail: NTIS HC A02/MF A01

Metal hydride compressors can compress hydrogen to high pressures without using mechanical moving parts. They are particularly suited for tritium applications because they require minimal maintenance. A three-stage metal hydride compressor which can compress hydrogen from 14.7 to 20,000 psia has been demonstrated. The design principle and experimental results are presented. DOE

N86-27466# Oak Ridge National Lab., Tenn.
STABILITY AND COMPOSITION OF PALM, COCONUT AND SOY OIL FATTY ACID MICROEMULSION DIESEL FUELS
A. L. Compere, W. L. Griffith, and J. M. Googin 1985 8 p Presented at the 7th Miami International Conference on Alternative Energy Sources, Miami Beach., Fla., 9 Dec. 1985
(Contract DE-AC05-84OR-21400)
(DE86-005017; CONF-851201-10) Avail: NTIS HC A02/MF A01

Microemulsions fuels containing fully and partially coconut, palm, and soy fatty acids; varying amounts of C1 to C4 alcohols varying amounts of water; and four fuel bases were evaluated between O and 60 C for stability as a single phase system. In general, ability to form a stable single phase system rose with increasing alcohol chain length, decreasing water, and increasing dispersed phase content. It was possible to form O to 60 C stable single phase systems in all four fuels tested using 30 to 50% v/v dispersed phase containing 1-butanol and either palm or soy fatty acids. DOE

N86-27374# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
PYROTECHNIC VALVES, MINIATURE PYROMECHANISMS, AND PYROTECHNIC NUTS
J. C. Slama *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 139-143 In FRENCH (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27480# Joint Publications Research Service, Arlington, Va.
ALTERNATIVES TO GASOLINE EXPLORED
I. Irmscher *In its* East Europe Report (JPRS-EER-86-031) 4 Mar. 1986 p 54-63 Transl. into ENGLISH from KFT-Kraftfahrzeugtechnik (East Berlin, East Germany), no. 11, Nov. 1985 p 328-330 (For primary document see N86-27479 18-31)
Avail: NTIS HC A08/MF A01

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N86-27467*# National Aeronautics and Space Administration. Pasadena Office, Calif.
OXYGEN CHEMISORPTION CRYOGENIC REFRIGERATOR Patent Application
Jack A. Jones, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena) Filed 24 Apr. 1986 15 p Sponsored by NASA
(NASA-Case-NPO-16734-1-CU; NAS 1.71:NPO-16734-1-CU; US-Patent-Appl-SN-855982) Avail: NTIS HC A02/MF A01 CSCL 13I

The present invention relates to a chemisorption compressor

cryogenic refrigerator which employs oxygen to provide cooling at 60 K to 100 K. The invention includes dual vessels containing an oxygen absorbent material, alternately heated and cooled to provide a continuous flow of high pressure oxygen, multiple heat exchangers for precooling the oxygen, a Joule-Thomson expansion valve system for expanding the oxygen to partially liquefy it and a liquid oxygen collection vessel. The primary novelty of the present invention lies in the provision of a refrigeration system which makes use of reversible chemical reactions with oxygen to provide cooling at 60 K to 100 K. NASA

N86-27468# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 18, NO. 1 Monthly Report
Judith Nagle-Eshleman, ed. Jan. 1986 116 p
(AD-A165726) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Topics addressed include: mechanical systems, analysis and design, structural systems, vehicle systems, biological systems, mechanical components, structural components, electric components, dynamic environment, mechanical properties, and experimentation. Literature review of the behavior of elastomeric material under dynamic loads and rotor instability in centrifugal pumps is also presented. For individual titles, see N86-27469 through N86-27470.

N86-27469# General Dynamics Corp., Groton, Conn. Electric Boat Div.
BEHAVIOR OF ELASTOMERIC MATERIALS UNDER DYNAMIC LOADS, PART 4 Monthly Report c27
C. A. Caseiro *In* Shock and Vibration Information Center The Shock and Vibration Digest, Volume 18, No. 1 Jan. 1986 p 3-6 (For primary document see N86-27468 18-31)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Literature published since 1982 on the behavior of rubber material under sinusoidal forces is reviewed. The most significant advances concern the correlation of dynamic properties and molecular structure. Author

N86-27470# Weir Pumps Ltd., Glasgow (Scotland).
ROTOR INSTABILITY IN CENTRIFUGAL PUMPS Monthly Report c37
D. France *In* Shock and Vibration Information Center The Shock and Vibration Digest, Volume 18, No. 1 Jan. 1986 p 3-6 (For primary document see N86-27468 18-31)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

The literature describing rotor instability phenomena in centrifugal pumps is reviewed. Discussion is confined to subsynchronous instabilities classified according to origin and in terms of the fractional frequency ratio of occurrence. When possible, the underlying mechanisms of the instabilities are described. Author

N86-27471# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 17, NO. 8 Monthly Report
Judith Nagle-Eshleman, ed. Aug. 1985 117 p
(AD-A165115) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Topics adressed include mechanical systems, structural systems, vehicle systems, biological systems, mechanical components, electric components, structural components, analysis and design, dynamic environment, mechanical properties, and experimentation. Literature on noise transmission into propeller aircraft is reviewed. Computer automated failure predictions in mechanical systems are discussed. For individual titles, see N86-27472 through N86-27473.

N86-27472# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
COMPUTER-AUTOMATED FAILURE PREDICTION IN MECHANICAL SYSTEMS UNDER DYNAMIC LOADING Monthly Report c38
C. W. deSilva *In* Shock and Vibration Information Center(Defense), The Shock and Vibration Digest, Volume 17, No. 8, Aug. 1985 p 3-12 (For primary document see N86-27471 18-31)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

A computer-automated system for failure prediction in mechanical systems having many components that are functionally and physically interconnected is described. This system consists of three subsystem modules: component failure models developed from available data and procedures; reliability model for the overall mechanical system, developed using functional interrelations and failure models of individual components; and failure diagnostic and model-parameter updating system. The general structures of these three modules and their role in obtaining accurate predictions for time and mode of next failure are discussed. Pertinent background information is provided. Author

N86-27473# Columbia Univ., New York. Dept. of Civil Engineering.
NOISE TRANSMISSION INTO PROPELLER AIRCRAFT Monthly Report c71
R. Vaicaitis *In* Shock and Vibration Information Center(Defense), The Shock and Vibration Digest, Volume 17, No. 8 , Aug. 1985 p 15-20 (For primary document see N86-27471 18-31)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Papers and reports, most of which were written since 1981, that are concerned with airborne and structure-borne noise transmission into a propeller-driven aircraft are surveyed. Special attention is given to a new propfan aircraft. Author

N86-27474# MMR Technologies, Inc., Mountain View, Calif.
DEVELOPMENT OF A LOW NOISE 10K JT. REFRIGERATION SYSTEM Final Technical Report
Feb. 1986 12 p
(Contract N00014-85-C-0428)
(AD-A165154) Avail: NTIS HC A02/MF A01 CSCL 13/1

This report summarizes the results of an engineering design program to develop a low noise, closed cycle, Joule-Thomson, microminiature refrigeration system for 10K operation. During this period the effort has been focused on the fabrication of the argon and hydrogen stages of the three stage cooler. A test facility was designed and built which allows one to mount each refrigerator on a separate removable base and to test each in turn. Key to the successful fabrication of the refrigerator is the determination of the proper firing profile for sealing the refrigerator components. Three batches of refrigerators have been built to date, and reasonable yields are now being obtained for the fabrication of these stages. The helium stage has been designed and laid out, and the photomasks prepared. Work has continued on the hydraulically actuated compressor. GRA

N86-27475# Oak Ridge National Lab., Tenn.
DESIGN AND FABRICATION OF THE VACUUM VESSEL FOR THE ADVANCED TOROIDAL FACILITY
K. K. Chipley and G. N. Frey 1985 4 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov., 1985 Prepared in cooperation with Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
(Contract DE-AC05-84OR-21400)
(DE86-003273; CONF-851102-51) Avail: NTIS HC A02/MF A01

The vacuum vessel for the Advanced Toroidal Facility (ATF) is a heavily contoured and very complex formed vessel that is specifically designed to allow for maximum plasma volume in a pure stellarator arrangement. The design of the facility incorporates an internal vessel that is closely fitted to the two helical field coils following the winding law theta = 1/6phi. Metallic seals have been incorporated throughout the system to minimize impurities. The vessel has been fabricated utilizing a comprehensive set of tooling fixtures specifically designed for the task of forming

6-mm stainless steel plate to the complex shape. Computer programs were used to develop a series of ribs that essentially form an internal mold of the vessel. Plates were press-formed with multiple compound curves, fitted to the fixture, and joined with full-penetration welds. DOE

N86-27476# Lawrence Livermore National Lab., Calif.
DESIGN, CONSTRUCTION, AND TESTING OF THE VACUUM VESSEL FOR THE TANDEM MIRROR FUSION TEST FACILITY
J. W. Gerich Nov. 1985 27 p Presented at the 32nd National Vacuum Symposium and Topical Conference, Houston, Tex., 19 Nov. 1985
(Contract W-7405-eng-48)
(DE86-003476; UCRL-92732; CONF-851174-18) Avail: NTIS HC A03/MF A01

In 1980, the US Department of Energy gave the Lawrence Livermore National Laboratory approval to design and build a tandem Mirror Fusion Test Facility (MFTF-B) to support the goals of the National Mirror Program. We designed the MFTF-B vacuum vessel both to maintain the required ultrahigh vacuum environment and to structurally support the 42 superconducting magnets plus auxiliary internal and external equipment. During our design work, we made extensive use of both simple and complex computer models to arrive at a cost-effective final configuration. As part of this work, we conducted a unique dynamic analysis to study the interaction of the 32,000-ton concrete-shielding vault with the 2850-ton vacuum vessel system. To maintain a vacuum of 2 x 10 to the -8 Torr during the physics experiments inside the vessel, we designed a vacuum pumping system of enormous capacity. The vacuum vessel (4200 cu m) has been fabricated, erected, and acceptance tests have been completed at the Livermore site. The rest of the machine has been assembled, and individual systems have been successfully checked. On October 1, 1985, we began a series of integrated engineering tests to verify the operation of all components as a complete system. DOE

N86-27477# Iowa Univ., Iowa City. Inst. of Hydraulic Research.
NALED ICE GROWTH
G. A. Schohl and R. Ettema Feb. 1986 205 p
(Grant NSF CEE-81-09252)
(PB86-168200; IIHR-297) Avail: NTIS HC A10/MF A01 CSCL 13B

Based on theoretical formulation and dimensional analysis, supported by the results of laboratory experiments, a theory and a detailed description of naled ice growth are presented. The theory, concepts, and data should be of interest to engineers concerned with the effects of naleds (also referred to as aufeis or icings) on engineering works. The growth of a two dimensional, or laterally confined (flume), naled is shown to depend primarily on seven, independent, dimensionless parameters. The early, two dimensional, phase of growth, a naled consists of a mixture of ice and water, or ice-water slush, forming on a frigid base. The influence of two of the three remaining parameters is not felt until after a transition time has passed. The continuing, cyclic process by which slush layers form and eventually freeze results in the ice laminations that are a feature of naled ice. GRS

N86-27478# National Bureau of Standards, Gaithersburg, Md.
THERMOMETRY Final Report
J. F. Schooley Mar. 1986 30 p
(PB86-181369; NBSIR-85/3133) Avail: NTIS HC A99/MF A01 CSCL 13H

The manuscript develops the concept of thermometry, including historical experiments and thermodynamics; the Kelvin thermodynamic temperature scale; international practical temperature scales; the thermodynamic methods used to realize the Kelvin scale; and modern types of thermometers. Nearly 400 bibliographic references are included. GRA

N86-27479# Joint Publications Research Service, Arlington, Va.
EAST EUROPE REPORT
4 Mar. 1986 174 p Transl. into ENGLISH from various East European articles
(JPRS-EER-86-031) Avail: NTIS HC A08/MF A01

East Europe Reports (JPRS-EER-86-031), 4 March 1986, contains reports on the agriculture, economy, military forces, politics, science and technology, and sociology of the countries of Eastern Europe. Of special interest in this issue are articles on gasoline fuel alternatives, and a new fighter-bomber (the Su-22) assigned to the East German Air Force. For individual titles, see N86-27480 through N86-27481.

N86-27480# Joint Publications Research Service, Arlington, Va.
ALTERNATIVES TO GASOLINE EXPLORED **c28**
I. Irmscher *In its* East Europe Report (JPRS-EER-86-031) 4 Mar. 1986 p 54-63 Transl. into ENGLISH from KFT-Kraftfahrzeugtechnik (East Berlin, East Germany), no. 11, Nov. 1985 p 328-330 (For primary document see N86-27479 18-31)
Avail: NTIS HC A08/MF A01

At the Berlin-Wartenberg Engineering College, a study was made of the possibilities for using nonfossil energy sources as alternative fuels in consideration of the specific agricultural conditions of the GDR. The point of departure was the requirement for the economic use of diesel fuel, the search for possibilities for replacing diesel fuel with domestic energy sources, especially biogas, and agriculture's very important share--about one-fifth--of the national economy's overall requirement for diesel fuel. Author

N86-27481# Joint Publications Research Service, Arlington, Va.
NEW FIGHTER-BOMBER IN AIR FORCE **c01**
In its East Europe report (JPRS-EER-86-031) 4 Mar. 1986 p 103-104 Transl. into ENGLISH from Soldat und Technik (Frankfurt/Main, West Germany), no. 12, Dec. 1985 p 786 (For primary document see N86-27479 18-31)
Avail: NTIS HC A08/MF A01

FITTER K, currently the latest version of the FITTER fighter-bomber series from Sukhoi, along with other East German Air/Air Defense Force [EGAF/AD] aircraft of Soviet and Czechoslovak manufacture, was displayed on the ground and in the air during a troop review in August of this year. The appearance of this aircraft in the East German Army--deliveries allegedly began already in 1981--is indicative of the continuing modernization and strengthening of air attack forces in East Germany. Derived from the Su-22BM (M = modified) FITTER H, FITTER K is likewise equipped with the afterburner turbojet engine AL-21F of A. Lyulka, but differs externally from it in having a square-shaped supplementary air intake in the dorsal bulge in the ascending vertical fin. It is assumed that a parallel series was built having the higher-output Tumanskv engine R-29B. This version can be recognized by the somewhat larger fuselage cross-section in the area of the engine. The bomb and missile armament can be distributed among eight weapons stations (pylons), three each beneath the rigid wing center sections and two beneath the fuselage. The relatively short, adjustable outer wing sections are not loadable in any of the FITTER swing-wing versions. Author

N86-27482# Joint Publications Research Service, Arlington, Va.
CHINA REPORT: SCIENCE AND TECHNOLOGY
1 Mar. 1986 235 p Transl. into ENGLISH from various Chinese articles
(JPRS-CST-86-008) Avail: NTIS HC A11/MF A01

Topics addressed include: national developments, physical sciences, applied sciences, environmental quality, analytical chemistry, electronics, nuclear power engineering, and organic chemistry. For individual titles, see N86-27483 through N86-27500.

N86-27483# Joint Publications Research Service, Arlington, Va.
INSTABILITY IN LOWER IONOSPHERE AT LOW LATITUDE **c46**
Xuanmou Liu, Genghou Liu, Tao Gu, and Rong Cui *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 63-71 Transl. into ENGLISH from Wuhan Daxue Xuebao (Ziran Kexue Ban) (Wuhan, China), no. 2, Jun. 1984 p 39-44 (For primary

document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

In the lower ionosphere, a dc electric field is induced by the collision between charged and neutral particles. In addition, there is a vertical electron density gradient due to the presence of the Hall current induced by the Earth magnetic field and the partially ionized plasma in the ionosphere. Under these conditions, their combined effects will cause instabilities in this region. Based on the two-fluid plasma equation, the growth rate of these instabilities is derived. Numerical simulation of this instability shows some fluctuation in electron density in the lower ionosphere 150 seconds after the disturbance. The spatial scale of the undulation is of the order of several hundred meters to several kilometers. In addition, it has a tendency to move in the vertical and horizontal directions. Furthermore, the observation made during the solar eclipse in Yunnan of 16 February 1980 is also discussed. Author

N86-27484# Joint Publications Research Service, Arlington, Va.
CRYOGENICS OF CHINA'S NIOBIUM MATERIAL (Nb2-1) c76
Jiasu Wang and Suyu Wang *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 72-74 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 13, no. 5, Sep. 1985 p 119-120 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

The experimental research of the superconducting microwave surface resistance with China's niobium material at the liquid helium temperature is described. The measurement is made on X-band TE sub 011 mode cavity. Unloaded Q sub 0 value of 4.3x10 is achieved at a temperature of 4.2K. The equivalent residual surface resistance is .00018 omega. In superconducting material at very low frequencies, the superfluid current is dominant while the resistance effect is very tiny. Yet surface resistance exists in superconducting material in the microwave frequency band. The superconducting microwave surface resistance measured on X wave band highly pure niobium at a temperature of 1.3K was 1.5x10 to the - 9th power. The superconducting microwave surface resistance of X wave band measured highly pure niobium at 1.87K as .0000078 omega. The results are given of experimental research on a superconducting microwave resonator made of Chinese manufactured industrially pure cast niobium ingot and at 4.2K and 9984MHz the superconducting microwave surface resistance was measured at 0.00018 omega. Author

N86-27485# Joint Publications Research Service, Arlington, Va.
CONFOCAL LASER RESONATOR CHARACTERISTICS ANALYZED c36
Deyun Jin *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 75-80 Transl. into ENGLISH from Guangxue Xuebao (Acta Optica Sinica) (Shanghai, China), v. 5, no. 11, Nov. 1985 p 992-996 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

The dynamic oscillation characteristics of a special confocal resonator with G sub 1=0 and G sub 2=0 were analyzed. This resonator shows oscillation characteristics of a Gaussian standing-wave resonator, a critical resonator, and a traveling wave resonator, respectively, when the direction of the rectilinear motion equation for the resonator is changed. The method for designing the resonator is proposed. Experimental results are in agreement with theoretical analysis. Author

N86-27486# Joint Publications Research Service, Arlington, Va.
CHINESE ACADEMY OF SCIENCES STUDIES DH LASER c36
Qiming Wang *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 81-92 Transl. into ENGLISH from Tongxin Xuebao (Beijing, China), v. 6, no. 1, Jan. 1985 p 65-70 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

An investigation of Co-Cavity Two-Section (CCTS) AlGaAs/GaAs, InGaAsP/InP DH lasers is reported. It is shown that CCTS DH lasers have multiaction characteristics both in steady states and in transient states. As a three terminal device, the lasing state may be controlled by selecting the operating mode such as on or off and by controlling the pulse sequence. It is interesting that bistable behavior in the output can be obtained in these lasers under appropriate experimental conditions. Author

N86-27487# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF SECTIONAL CONSTRICTED PLANAR CO-CAVITY DH LASERS c36
Guotong Du, Deling Yang, and Dingsan Gao *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 93-96 Transl. into ENGLISH from Bandaoti Xuebao (Beijing, China), v. 6, no. 4, Jul. 1985 p 442-445 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

The development of sectional constructed planar cocavity DH lasers is reported. At present, lasers with a cavity length of 135 micrometers and dc threshold values of 30mA (27 C) were manufactured. Initial hypotheses for analyzing the mode characteristics for equivalent values over the whole cavity are suggested. Author

N86-27488# Joint Publications Research Service, Arlington, Va.
OUTPUT POWER EQUATION AND NUMERICAL INTEGRATING METHOD OF POSITIVE-BRANCH UNSTABLE CONFOCAL RESONATOR c74
Zuhai Cheng, Zaiguang Li, and Xuhui He *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 97-104 Transl. into ENGLISH from Guangxue Xuebao (Acta Optica Sinica) (Shanghai, China), v. 5, no. 11, Nov. 1985 p 986-991 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

The output power equation of a positive-branch unstable confocal resonator was deduced by using the numerical integrating method and dividing the resonator to two regions. The numerical results of this equation are in good agreement with experimental data. Author

N86-27489# Joint Publications Research Service, Arlington, Va.
CHARACTERISTIC OF VANE-LOADED HELIX SLOW-WAVE STRUCTURE c33
Qingyou Chen *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 105-116 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 11, no. 5, Sep. 1983 p 23-32 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

Based on the existing vane loaded helix slow wave structure, a theoretical analytic model is proposed, in which the space between the helix and metallic barrel is fully filled up with dielectric, and vanes, infinite in number and infinitely thin in thickness, are set along all over the inner wall of the barrel. By utilizing the matching method of regional electromagnetic field for individual regions, the electromagnetic field distribution in the space of three respective regions is found. And the dispersion equation, couple impedance and attenuation constant are then obtained. The propagation system of electromagnetic wave is also discussed, with S being the cross section of any shape. A principle of stored energy equilization is derived. Author

N86-27490# Joint Publications Research Service, Arlington, Va.
IMPROVEMENT OF LARGE SIGNAL INTERACTION MODEL FOR TWT c32
Wenmiao Song, Yongquan Liu, and Jingxian Wu *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 117-126 Transl. into ENGLISH from Dianzi Kexue Xuekan (Beijing, China), v. 7, no. 2, Mar. 1985 p 136-143 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

Because of the nonconservation of energy in Rowe's model for large signal interaction in traveling wave tubes (TWT), Rowe's model produces considerable error in TWT design, especially for a velocity-tapered one. A modified model which is based on energy conservation is suggested to improve the accuracy of the

design of TWT. By the new model, when the loss and space charge in TWT are neglected, the energy received by the circuit is exactly equal to that given by the electron beam. All the results obtained with the new model are in better agreement with the actual cases than those obtained with Rowe's model. Author

N86-27491# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL EXPERT SYSTEM, BLOCK, FOR USE IN CIRCUIT DESIGN **c33**
Yongsui Fang, Jiren Lu, Zongxuan Hu, and Zhaoming Wang *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 127-135 Transl. into ENGLISH from Dianzi Kexue Xuekan (Beijing, China), v. 7, no. 2, Mar. 1985 p 92-97 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

A practical expert system called block is created for analog circuit design, the goal being to use this research to implement ways and means of high level circuit expert systems. Block system only requires the output and input signal demands of the given circuit to complete the block design of the circuit automatically and rapidly while these these tasks ordinarily must be done by the circuit designer. Author

N86-27492# Joint Publications Research Service, Arlington, Va.
VERTICAL POLARIZED ANTENNA FOR SYNTHETIC APERTURE RADAR **c32**
Ruxian Wang and Guanhong Shen *In its* China Report: Science and Technology (JPRS-CST-98-008) 1 Mar. 1986 p 136-140 Transl. into ENGLISH from Dianzi Kexue Xuekan (Beijing, China), v. 7, no. 2, Mar. 1985 p 158-160 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

A simple design model of a vertical polarized antenna operated in the X-Band is described. This antenna consists of longitudinal shunt slottery array at the broad side of rectangular waveguide and metallic horned plates. A full size model was fabricated. The computed results are in agreement with measured ones approximately. Although this method is preliminary, it has practical value in antenna design. Author

N86-27493# Joint Publications Research Service, Arlington, Va.
CY SERIES INTEGRATED PRESSURE TRANSDUCER **c35**
Minhang Bao and Jishen Jiang *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 141-147 Transl. into ENGLISH from Dianzi Kexue Jishu (Beijing, China), no. 12, 10 Dec. 1984 p 25-26, 28 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

The CY series integrated pressure transducer is a new third generation semiconductor pressure sensing element whose primary performance indicators have reached or surpassed the advanced levels for similar products abroad. In order to make the transducer have ideal performance parameters, the CY series pressure transducer integrates on one chip a pressure sensitive bridge, signal amplification circuit, and temperature compensation circuit. Since silicon material <100> crystal orientation has a mature etching process and at the same time is more ideal for integrated circuit process, therefore P-type <100> crystal orientation silicon chips were chosen for the CY series products, and pressure-sensitive resistance lines follow <011> and <011> crystal orientation. Author

N86-27494# Joint Publications Research Service, Arlington, Va.
NEW DT(SUP)2L SYSTEM OF LARGE-SCALE INTEGRATED CIRCUIT DESCRIBED **c33**
Yanhong Li *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 148-157 Transl. into ENGLISH from Dianzi Kexue Jishu (Beijing, China), no. 12, 10 Dec. 1984 p 8-11, 18 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

A simplified gate circuit and trigger is presented based on existing transistor-transistor logic (TTL) circuits to create a new series. It is not only suited to China's existing technological level and package cooling technology, but also improves integration and speed and provides experimental proposals for developing China's own medium and large scale integrated circuit series. Author

N86-27495# Joint Publications Research Service, Arlington, Va.
ADMITTANCE OF RECTANGULAR WAVEGUIDE OF SLOT ARRAY MEASURED **c32**
Zhixin Li *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 158-163 Transl. into ENGLISH from Dianzi Kexue Xuekan (Beijing, China), v. 7, no. 3, May 1983 p 227-231 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

The serial feed waveguide H-plane slot array antenna is a widely used antenna type. The relationship between the waveguide slot conductance and the geometrical dimensions of the slot is the foundation for designing this type of antenna and the frequency characteristics of the slot admittance is an indispensable basis for analyzing the antenna's frequency characteristics. Although the formulas for theoretical analysis can be applied in designing a waveguide slot array antenna, there are some irregularities between the results obtained and the actual situation; therefore, before design, the conductance of the waveguide antenna is measured. Because the conductance of a single slot is rather small, it is difficult to measure accurately and in addition, there is coupling between slots, thus people generally measure the slot conductance of many slots in the array. To analyze and predict the frequency characteristics of a serial feed waveguide H-plane slot array antenna and improve the antenna's broad-band performance, an easy, computer-aided method of measuring the admittance frequency characteristics in a slotted array is proposed the results of measurement are presented. From the results it can be seen that the frequency characteristics of slot admittance are regular. Author

N86-27496# Joint Publications Research Service, Arlington, Va.
DESIGN OF OPTICAL DETECTOR, RECEIVER DISCUSSED **c74**
Guoxiang Li and Jingde Xu *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 164-168 Transl. into ENGLISH from Dalian Gongxueyuan Xuebao (Dalian, China), v. 24, no. 3, Sep. 1985 p 121-124 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

An optical band signal receiving unit is, in many aspects, similar to a radio receiver system. It is composed of a photodetector, receiver, and terminal. A radio receiver unit includes an antenna, receiver, and terminal. They are also similar in major technical areas such as sensitivity, frequency response (including selectivity), non-linear distortion, signal to noise ratio and miscode ratio. Based on these facts, the duality of an optical band signal receiver unit and a radio receiver unit is presented. The following dualities exist: photodetector versus receiving antenna, receiver versus receiver, and terminal versus terminal. Based on these dualities, a photodetector is considered as a receiving antenna. Then, an optical band signal receiving device can be modelled as a radio receiving device. Thus the design theory for radio receiving equipment can be used for optical frequency band signal receiving equipment. Author

N86-27497# Joint Publications Research Service, Arlington, Va.
DESIGN SCHEME OF 8mm HIGH-POWER COAXIAL MAGNETRON DESCRIBED **c33**
Mingye Chen *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 169-173 Transl. into ENGLISH from Dianzi Kexue Xuekan (Beijing, China), v. 6, no. 3, May 1984 p 259-281 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

There are two opinions on the feasibility of coaxial structure for magnetrons at 8mm wave band. One opinion is that when approaching the 8mm wave band, only an anti-coaxial structure can be used, while another opinion is that a coaxial structure can still be realized at 8mm wave band provided that high magnetic

conduction material is employed for the terminal boot, and high strength oxygen-free copper is used for the internal resonant chamber, as well as employing line cutting method to process. Currently, there is still difficulty in obtaining high magnetic conduction material for use in vacuum and air tight environments. The processing method of line cutting is still primarily employed in scientific research, and there is a certain degree of difficulty for batch production plants. A new design scheme is proposed and tested with positive results. Author

N86-27498# Joint Publications Research Service, Arlington, Va.
ENGINEERING STANDARD OF MOS MEMORY MODULE c60
Jingdong Chen, Zucai Zhu, and Zhongquan Xu *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 174-179 Transl. into ENGLISH from Jisuanji Yanjiu Yu Fazhan (Beijing, China), v. 21, no. 11, Nov. 1984 p 30-36 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

Mankind has entered the information society, and information storage is an important technology of the information age. Not only is it needed in computer design, but it is also indispensable in many kinds of electronic control equipment. The MOS RAM is already widely used in many different fields. At present, domestic research and manufacture of computers is flourishing. In order to speed up the lead-time cycle of these machines and to enhance their performance reliability so as to promote the development of information storage technology, in February of 1984 the China Computer Society's storage technology group invited experts from concerned units throughout the country to Jiangsu Shazhou (Computer) Storage Plant to hold a meeting to examine and approve an MOS memory module standard, and a draft of the standard was approved. It combines the achievements of the past few years of experience in the research and manufacture of MOS memory; the data contained in the standard are derived from articles from two conferences on information storage technology and from the practical experience of the units represented by the participating experts. This standard lists the testing standards and engineering design principles for the research and manufacture of MOS RAM devices; it does not go into the details of the production process. Author

N86-27499# Joint Publications Research Service, Arlington, Va.
CZOCHRALSKI GROWTH OF TUNABLE LASER CRYSTAL BeAl(SUB)2O(SUB)4:Cr(SUP)3+ c76
Xiaoshan Ma, Yinchun Hou, Siting Wang, Yafang Shen, and Zongru Jin *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 186-193 Transl. into ENGLISH from Guisuanyan Xuebao (Beijing, China), v. 12, no. 2, Jun. 1984 p 131-136 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

Optically homogeneous alexandrite blanks, 100 mm in length and 20 mm in diameter, were grown by Czochralski technique using RF heating. These blanks were fabricated into 90 mm long 5 mm diameter c-axis laser rods. Tunable laser output was obtained experimentally. Spectroscopic characteristics of the crystal were presented. Problems such as prevention of BeO contamination, chrysoberyl formation kinetics and melt aging are also discussed. Author

N86-27500# Joint Publications Research Service, Arlington, Va.
ALUMINUM-GRAPHITE COMPOSITE MATERIALS STUDIED c24
Lida Liang *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 194-199 Transl. into ENGLISH from Dalian Gongxueyuan Xuebao (Dalian, China), v. 24, no. 3, Sep. 1985 p 109-112 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

The wear reduction, damping capacity and technical properties of rheocast aluminum-graphite composite materials were tested. The effect of graphite content on various properties was determined to serve as a technical basis for this type of materials. Author

N86-27501# Joint Publications Research Service, Arlington, Va.
CHINA REPORT: SCIENCE AND TECHNOLOGY
13 Mar. 1986 161 p Transl. into ENGLISH from various Chinese articles
(JPRS-CST-86-009) Avail: NTIS HC A08/MF A01

China Report - Science and Technology (JPRS-CST-86-009), 13 March 1986, contains articles on National Developments, Physical Sciences, and Applied Science. Of special interest in this issue are articles on ultrasonic holography, slotted antennas, end-fed array antennas, coupled-cavity TWT's, a dynamic balance test facility, free-electron lasers, optical disk media, laser pulse compression, standing wave wigglers, carbon dioxide isotope lasers, and X-ray lasers. For individual titles, see N86-27502 through N86-27512.

N86-27502# Joint Publications Research Service, Arlington, Va.
IMAGING EQUATION, OPTIMUM ESTIMATION, ALGORITHM OF ULTRASONIC HOLOGRAPHY c35
Zaiming Li and Junti Wu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 43-51 Transl. into ENGLISH FROM Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 13, no. 3, May 1985 p 71-76 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

The imaging equation, optimum estimation model and computer algorithm of ultrasonic Fourier holography are discussed. The effect of background interference and its elimination are analyzed. Good results were obtained using this model and algorithm. To facilitate computer processing of multi-dimensional information, an information estimation and functional analysis method was employed to discuss ultrasonic Fourier holography. This method has advantages such as clear concept and well-defined capabilities. Furthermore, it can facilitate software design. The resulting imaging effect is better than that reported in the literature. Author

N86-27503# Joint Publications Research Service, Arlington, Va.
COUPLING PROPERTIES OF SLOTTED ANTENNA STUDIED c32
Shanwei Lu, Jishi Ren, and Yin Fang *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 54-70 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 13, no. 5, Sep. 1985 p 92-101 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

Coupling properties of any two longitudinal slots in the wider walls of a rectangular waveguide are analyzed. The theoretical results are in good agreement with the experimental results and with the data previously obtained (for single slot and half-wavelength slots). Based on the calculated and the experimental results, the electric field distribution at the aperture surface, the admittance, the resonant conductance, and the resonant length of the slots are discussed, taking into account both the effects of external and internal mutual coupling between the slots. The effects of the waveguide wall thickness and narrow-side width are also discussed. Author

N86-27504# Joint Publications Research Service, Arlington, Va.
RADAR ANTENNA TRANSIENT EFFECTS STUDIED c32
Hannan Hu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 71-81 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 11, no. 6, Nov. 1983 p 80-87 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

The problem of transient effect of one-dimensional end-fed array antennas is discussed. It is shown that the transient effect of end-fed array antennas will deteriorate the angular resolution performance in radar systems, and that such influence is more serious to radars sensitive to the amplitudes of very short pulses. Author

N86-27505# Joint Publications Research Service, Arlington, Va.
LARGE SIGNAL THEORY, COMPUTATION OF COUPLED-

CAVITY TWT'S c33
Wenmiao Song and Zhenhuai Li *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 82-93 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 12, no. 3, May 1984 p 25-32 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

The physical model and numerical method for CCTWT's large-signal interaction are given. In this model, the electrical field distribution in the gap (both modulus and phase angle) as well as the backward wave influence and the relativistic effect are considered. The mechanism of the electron beamwave interaction is discussed in great detail. Since the model uses the energy conservation law as a rule for the interaction, the computational results conform with the law accurately. The computation for an X-band CCTWT shows good agreement with the experiment values. Author

N86-27506# Joint Publications Research Service, Arlington, Va.
FIRST FREE-ELECTRON LASER OPERATIONAL c36
Cheng Zhu, Zaitong Lu, Ruigen Shi, Zhijiang Wang, Jinchuan Shi, and Yu Hu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 95 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 12, p 767 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

Output from China's first free-electron laser has been obtained. This free-electron laser is based on stimulated Raman scattering. Author

N86-27507# Joint Publications Research Service, Arlington, Va.
OPTICAL DISK MEDIA RESEARCH DISCUSSED c35
Jinchun Hou and Fuxi Gan *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 96-110 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 12, p 705-712 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

A review of the current status of the research and development on various optical disk media is presented. It is noted that research around the world on the media for the nonerasable optical disk is almost over, and that the nonerasable optical disk has been successfully used for CD, LD player and DRAW devices. On the other hand, great efforts are now being made to search the more suitable media for erasable optical disks. Extensive experiments on various material systems including optical characteristic change, phase transition and magneto-optical recording media are under way. It is expected that fruitful results will appear in the next 2 or 3 years. Author

N86-27508# Joint Publications Research Service, Arlington, Va.
LASER PULSE COMPRESSOR AND PHASE-COMPENSATOR DESCRIBED c36
Cunkai Wu, Guang Lan, Jie Xu, and Guozheng He *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 115-117 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 12, 20 Dec. 1985 p 750-751 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

In the development of nonlinear phase conjugate optics, a number of phase conjugate cavity and phase conjugate mirrors have been proposed for the phase anomaly in the laser amplifier. A composite laser system with a stimulated Brillouin scattering (SBS) conjugate mirror was studied and 200 mJ of output was obtained using a polarization isolation technique. Pulse compression was observed using the usual capillary Brillouin cell and using a ruby laser as a pump. Higher order pulse compression was achieved with a long conical capillary Brillouin cell. In this work, the composite laser system and the conical capillary Brillouin scattering conjugate mirror were combined. Using a polarization isolation method, the compressed laser pulse is completely coupled out. Using a 670 mm tapered capillary Brillouin cell containing CS2 liquid, the pulse width of the Q-switched Nd:YAG laser amplifier in the composite system is compressed by a factor of 3. The laser pulse energy is more than 240 mJ. The degree of compression depends on the length of the capillary; by changing the length of the Brillouin cell, it is possible that a variable pulse width laser can be made. Author

N86-27509# Joint Publications Research Service, Arlington, Va.
STANDING WAVE WIGGLERS USED IN FREE-ELECTRON LASER c36
Shizhan Lei *In its* China Report: Science and technology (JPRS-CST-86-009) 13 Mar. 1986 p 118-123 Transl. into ENGLISH from Hongwai Yanjiu (Shanghai, China), v. 4, no. 5, Oct. 1985 p 374-378 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

Operating conditions for free-electron lasers with a standing wave for wigglers are analyzed and the laser gains are calculated. A unique feature of free electron lasers is that the output wavelength can be tuned continuously by changing the energy of the relativistic electrons and the spatial period of the wiggler. In principle, output can be obtained in the infrared, ultraviolet, and even the X-ray range. A high energy relativistic electron beam is required to produce a short wavelength laser. Recently attempts have been made to obtain laser oscillation in the X-ray wavelength using free electron laser but great technical difficulties were encountered. Author

N86-27510# Joint Publications Research Service, Arlington, Va.
THE (SUP)14 CO (SUB)2 ISOTOPE LASER DESCRIBED c36
Lin Fei, Kejun Wang, and Zuhui Zhu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 124-130 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 9, 20 Sep. 1985 p 524-527 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

A (14)CO2 - (12)CO2 isotope laser has been developed and 80 laser lines were measured. Forty lines originated from lasing transition of the I band of (14)CO2 and the strongest line output power was over 4.0 W. The competition effect between isotopes were experimentally observed and domination of lasing radiation of (14)CO2 was found even when the content of (14)CO2 was less than (12)CO2. Author

N86-27511# Joint Publications Research Service, Arlington, Va.
AUTO-ALIGNMENT DEVELOPED FOR LARGE LASER SYSTEM c36
Wucheng Wang, Jianxiong Wang, Hengxian Wu, Ruoju Guo, Jingxin Yang, and Shiyuan Hu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 131-139 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 9, Sep. 1985 p 542, 543-546 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

A principle of optical path adjustment by servo-control mechanism is proposed. A computer program based on this principle has been successfully used in the auto-alignment of a laser system. A large laser system usually consists of an oscillator, a number of amplifiers and extensive optics. While in operation it is difficult to keep the laser beam from drifting. For example, the optical path of the pulsed solid state laser system used in nuclear fusion relies on an alignment control system so that the axial and angular drifts of the beams remain within a tolerable range. In this article we report our research results in this area. Author

N86-27512# Joint Publications Research Service, Arlington, Va.
TIME-RESOLVED X-RAY SPECTRA STUDIED c74
Chengming Pan, Guangyu Yin, Shicheng Zhao, and Daqing Zhu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 140-145 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 9, Sep. 1985 p 570-572 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

The interaction of laser light with plasma is described which offers X-rays directly or indirectly. The specifications as well as the calibration of the X-ray streak camera are presented. Its physical

application in laser produced plasma is indicated. X-ray emitted by the laser plasma plays a direct or indirect role in the interaction of laser and plasma. The characteristic length is several micrometers to several hundred micrometers and the characteristic time is several picoseconds to several hundred picoseconds. A device for diagnosing the time resolved X-ray must therefore have a time resolution of several picoseconds to several hundred picoseconds. An X-ray streak camera is designed for this specific purpose. Before an X-ray streak camera is put in use, it must be calibrated for time resolution, dynamic range, scanning linearity, and trigger jittering. Its intensity and linear output range must be quantified together with its spectral resolution devices such as reflecting mirrors and filters. Author

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N86-27513* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

METHOD AND APPARATUS FOR OPERATING ON COMPANDED PCM VOICE DATA Patent

Frank Byrne, inventor (to NASA) Issued 13 May 1986 8 p Filed 28 Sep. 1984 Supersedes N85-29120 (23 - 18, p 3089) Sponsored by NASA. Kennedy Space Center

(NASA-Case-KSC-11285-1; US-Patent-4,588,986; US-Patent-Appl-SN-655601; US-Patent-Class-340-347DD; US-Patent-Class-365-768; US-Patent-Class-179-18BC) Avail: US Patent and Trademark Office CSCL 17B

The method and apparatus constructed in accordance with this invention permits a plurality of parties to speak to each other on a conference line with a minimum of interference. The apparatus digitizes audio signals. Each of the parties has an audio transmitter and receiver provided for transmitting and receiving audio signals. The audio signals are converted to a PCM companded eight-bit parallel signal followed by a conversion to a serial signal for transmitting to a remote location and then reconverting each of the companded signals to a first-eight-bit parallel signal. The eight-bit parallel signal is fed to one input of a pre-programmed ROM. This eight-bit signal provides one-half of a sixteen-bit address of a lookup ROM. The other half of the sixteen-bit ROM address is supplied by another suscriber over an identical circuit. NASA

N86-27514 British Broadcasting Corp., Kingswood (England). Engineering Div.

SATELLITE SOUND BROADCASTING TO FIXED, PORTABLE AND MOBILE RADIO RECEIVERS

J. H. Stott Dec. 1985 14 p

(BBC-RD-1985/19) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Direct broadcasting by satellite (DBS) of television signals to the home has received much attention recently; less attention has been paid to sound-only (i.e., radio) broadcasting from satellites. This Report reviews the present range of terrestrial sound broadcasting and explores the possible scope and technical feasibility of using satellites. Satellite broadcasting of sound programs to receivers of all types, including portable and mobile, situated in national or regional areas appears technically practicable, but there are problems to be overcome. The most significant are regulatory in nature, in particular there is no appropriate frequency allocation. A new system possibility is presented using digital modulation which has a number of advantages, including potential for good spectrum utilization. Various technical details require further study to produce a system of optimum performance, flexibility and spectrum efficiency. Author

N86-27515*# North Carolina State Univ., Raleigh. Dept. of Electrical and Computer Engineering.

ON THE ELECTROMAGNETIC SCATTERING FROM INFINITE RECTANGULAR CONDUCTING GRIDS

Christos Christodoulou May 1985 171 p

(Grant NsG-1588)

(NASA-CR-177236; NAS 1.26:177236) Avail: NTIS HC A08/MF A01 CSCL 20N

The study and development of two numerical techniques for the analysis of electromagnetic scattering from a rectangular wire mesh are described. Both techniques follow from one basic formulation and they are both solved in the spectral domain. These techniques were developed as a result of an investigation towards more efficient numerical computation for mesh scattering. These techniques are efficient for the following reasons: (a1) make use of the Fast Fourier Transform; (b2) they avoid any convolution problems by converting integrodifferential equations into algebraic equations; and (c3) they do not require inversions of any matrices. The first method, the SIT or Spectral Iteration Technique, is applied for regions where the spacing between wires is not less than two wavelengths. The second method, the SDCG or Spectral Domain Conjugate Gradient approach, can be used for any spacing between adjacent wires. A study of electromagnetic wave properties, such as reflection coefficient, induced currents and aperture fields, as functions of frequency, angle of incidence, polarization and thickness of wires is presented. Examples and comparisons or results with other methods are also included to support the validity of the new algorithms. Author

N86-27516*# North Carolina State Univ., Raleigh. Dept. of Electrical and Computer Engineering.

ON THE CONVERGENCE OF AN ITERATIVE FORMULATION OF THE ELECTROMAGNETIC SCATTERING FROM AN INFINITE GRATING OF THIN WIRES

Jerry C. Brand May 1985 99 p Previously announced as N85-35319

(Grant NsG-1588)

(NASA-CR-177235; NAS 1.26:177235) Avail: NTIS HC A05/MF A01 CSCL 20N

Contraction theory is applied to an iterative formulation of electromagnetic scattering from periodic structures and a computational method for insuring convergence is developed. A short history of spectral (or k-space) formulation is presented with an emphasis on application to periodic surfaces. The mathematical background for formulating an iterative equation is covered using straightforward single variable examples including an extension to vector spaces. To insure a convergent solution of the iterative equation, a process called the contraction corrector method is developed. Convergence properties of previously presented iterative solutions to one-dimensional problems are examined utilizing contraction theory and the general conditions for achieving a convergent solution are explored. The contraction corrector method is then applied to several scattering problems including an infinite grating of thin wires with the solution data compared to previous works. Author

N86-27517*# Notre Dame Univ., Ind. Dept. of Electrical and Computer Engineering.

ERROR CONTROL TECHNIQUES FOR SATELLITE AND SPACE COMMUNICATIONS Annual Status Report, 1 Jun. 1985 - 31 May 1987

Daniel J. Costello, Jr. Jul. 1986 76 p

(Grant NAG5-557)

(NASA-CR-177224; NAS 1.26:177224) Avail: NTIS HC A09/MF A01 CSCL 17B

High rate concatenated coding systems with trellis inner codes and Reed-Solomon (RS) outer codes for application in satellite communication systems are considered. Two types of inner codes are studied: high rate punctured binary convolutional codes which result in overall effective information rates between 1/2 and 1 bit per channel use; and bandwidth efficient signal space trellis codes which can achieve overall effective information rates greater than 1 bit per channel use. Channel capacity calculations with and without side information performed for the concatenated coding

system. Concatenated coding schemes are investigated. In Scheme 1, the inner code is decoded with the Viterbi algorithm and the outer RS code performs error-correction only (decoding without side information). In scheme 2, the inner code is decoded with a modified Viterbi algorithm which produces reliability information along with the decoded output. In this algorithm, path metrics are used to estimate the entire information sequence, while branch metrics are used to provide the reliability information on the decoded sequence. This information is used to erase unreliable bits in the decoded output. An errors-and-erasures RS decoder is then used for the outer code. These two schemes are proposed for use on NASA satellite channels. Results indicate that high system reliability can be achieved with little or no bandwidth expansion. Author

N86-27518# Mnemoics, Inc., Saline, Mich.
ROAD DETECTION ON RADAR IMAGERY Final Report, Mar. 1984 - Jun. 1985
Jungwhan J. Kim and Robert M. Haralick Sep. 1985 73 p
(Contract DACA76-84-C-0003)
(AD-A164730; ETL-0403) Avail: NTIS HC A04/MF A01 CSCL 17/9

Detecting a road network on radar imagery is becoming a new area in remote sensing. This report is an attempt to build a facet-based road network detection procedure for radar imagery. This procedure includes the line detection part and the road detection and connection part. The first part analytically detects linear features using a facet valley-finding technique which looks for the first directional derivative zero-crossing of a bicubic facet model. The second part statistically screens the linear features on a component-by-component base and then optimally connects the screened linear features using a dynamic programming algorithm. GRA

N86-27519# Mnemoics, Inc., Saline, Mich.
NOISE REMOVAL ON RADAR IMAGERY USING LOCAL GRADIENT AND STATISTICS Final Technical Report, Mar. - Jul. 1984
Jugwhan Kim and Robert M. Haralick Sep. 1985 52 p
(Contract DACA76-84-C-0003)
(AD-A164888; ETL-0402) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report shows that the noise-removal algorithm using local gradient and statistics is most favorable to filter a noisy radar image without contrast loss. This report includes the summary of this algorithm with a suggestion of a practical method of estimating a local noise variance. Various noise-removal algorithms are compared with this algorithm based on a visual examination of their filtering results on a set of radar images. The final results of noise removal of the images are displayed along with the originals in the last section. A set of twenty-eight SAR (Synthetic Aperture Radar) images, of size 512x512 pixels, for experimentation.
Author (GRA)

N86-27520# Mnemoics, Inc., Saline, Mich.
DISCRIMINATION OF WATER FROM SHADOW REGIONS ON RADAR IMAGERY USING COMPUTER VISION TECHNIQUES Final Report, Mar. 1984 - Jul. 1985
Jianzhong Qian and Robert M. Haralick Sep. 1985 139 p
(Contract DACA76-84-C-0003)
(AD-A164912; ETL-0404) Avail: NTIS HC A07/MF A01 CSCL 17/9

Unlike MSS LANDSAT imagery and other photography, the specific characteristics of the intensity of water and shadow reflectivity in SAR imagery make the task of discriminating between them extremely difficult. In this report, we analyze the mechanism of reflectivity of water and shadow on radar imagery and describe a scene-analysis system which consists of a texture-preserving noise-removal procedure as the preprocessing step, a probabilistic relaxation algorithm to do the low-level labeling, and a spatial reasoning procedure based on a relational model to perform the high-level interpretation. The experimental results obtained from the SAR images are presented to illustrate the performance of this system. GRA

N86-27521# Haskins Labs., Inc., New Haven, Conn.
STATUS REPORT ON SPEECH RESEARCH. A REPORT ON THE STATUS AND PROGRESS OF STUDIES ON THE NATURE OF SPEECH, INSTRUMENTATION FOR ITS INVESTIGATION, AND PRACTICAL APPLICATIONS Interim Scientific Report, Apr. - Sep. 1985
Alvin M. Liberman Oct. 1985 298 p
(Contracts N00014-83-K-0083; PHS-N01-HD-5-2910; Grants HD-01994; HD-16591; RR-05596; NSF BNS-81-11470; NS-13870; NS-13617; NS-18010)
(AD-A165084; SR-82/83(1985)) Avail: NTIS HC A13/MF A01 CSCL 05/7

This interim status report on speech research discusses the following topics: On Vagueness and Fictions as Cornerstones of a Theory of Perceiving and Acting: A Comment on Walter (1983); The Informational Support for Upright Stance; Determining the Extent of Coarticulation-effects of Experimental Design; The Roles of Phoneme Frequency, Similarity, and Availability in the Experimental Elicitation of Speech Errors; On Learning to Speak; The Motor Theory of Speech Perception Revised; Linguistic and Acoustic Correlates of the Perceptual Structure Found in an Individual Differences Scaling Study of Vowels; Perceptual Coherence of Speech: Stability of Silence-cued Stop Consonants; Development of the Speech Perceptuomotor System; Dependence of Reading on Orthography-Investigations in Serbo-Croatian; The Relationship between Knowledge of Derivational Morphology and Spelling Ability in Fourth, Sixth, and Eighth Graders; Relations among Regular and Irregular, Morphologically-Related Words in the Lexicon as Revealed by Repetition Priming; Grammatical Priming of Inflected Nouns by the Gender of Possessive Adjectives; Grammatical Priming of Inflected Nouns by Inflected Adjectives; Deaf Signers and Serial Recall in the Visual Modality-Memory for Signs, Fingerspelling, and Print; Did Orthographies Evolve?; The Development of Children's Sensitivity to Factors Inf luencing Vowel Reading. GRA

N86-27522# Naval Research Lab., Washington, D. C.
APPLICATIONS OF SPECTRAL ESTIMATION TECHNIQUES TO RADAR DOPPLER PROCESSING: SIMULATION AND ANALYSIS OF HF (HIGH-FRQUENCY) SKYWAVE RADAR DATA Interim Report
D. B. Trizna and G. D. McNeal 31 Dec. 1985 29 p
(AD-A165153; NRL-8950) Avail: NTIS HC A03/MF A01 CSCL 17/9

This work is the second paper in a series of studies of the application of spectral estimations techniques to Doppler processing of coherent radar signals. In this work, simulated high-frequency (HF) radar sea scatter time series are generated and processed by use of three different spectral estimation algorithms and the fast Fourier transform (FFT). The sea clutter is simulated by narrowband filtering a wideband Gaussian noise spectrum in the frequency domain, with filter widths appropriate to describe first-order Bragg lines and second-order continuum. Targets are introduced as sinusoids, stepped by 5 dB for eight different echo power values, and stepped in Doppler frequency for four different values relative to the clutter. These simulations identify problems that appear unique to Doppler processing of coherent radar data in the presence of broadband clutter, and are in distinction to the application of spectral estimation to processing in the spatial domain. In the latter case, the spectral contributions are generally narrowly confined in the angular power spectral estimate, and the aim is to separate these contributions in the presence of noise. The HF radar application is concerned with separation of weak targets in the presence of stronger clutter returns, which are relati vely broad compared to the target return. It appears that the Burg maximum entropy method allows the detection of targets in clutter under conditions which the FFT is incapable of detection with any degree of accuracy. Author (GRA)

N86-27523# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
EXPERIMENTAL VERIFICATION OF THE FAR FIELD CRITERIA FOR AFWAL'S COMPACT RANGE IN THE QUIET ZONE REGION Interim Report, Jun. 1983 - Jul. 1984
Hirsch M. Chizever and Brian M. Kent Oct. 1985 127 p
(AD-A165275; AFWAL-TR-85-1080) Avail: NTIS HC A07/MF A01 CSCL 20/14

In past years the radiation and scattering properties of aerospace components have been tested on large outdoor measurement ranges. The distance between the transmitting and receiving antenna (for radiation measurements) or target (for scattering measurements) is normally dictated by the far field criteria. Recent interest in the millimeter wavelength region and the need to measure larger targets requires longer distances between source and target to satisfy the far field condition. This report documents an alternative method of creating a space limited far field environment for radiation and scattering measurements using the compact range approach. However, some questions concerning the planarity of the aperture field have been raised by the scientific community. Field probe data is presented here which unquestionably verifies the planarity of the aperture field. GRA

N86-27524# Mitre Corp., McLean, Va.
PRELIMINARY DESIGN CONCEPTS FOR COMMAND AND CONTROL MODELING USING TIME WARP/HYPERCUBE
S. J. Laskowski, R. O. Nugent, and L. M. Sokol 14 Aug. 1985 61 p
(Contract F19628-84-C-0001)
(AD-A165511; MTR-84W00535) Avail: NTIS HC A04/MF A01 CSCL 15/3

The objective of this task was to develop and evaluate preliminary design concepts for modeling command and control (C2) on the hypercube parallel processing computer architecture using the associated Time Warp operating system. MITRE performed this task in support of the Army Model Improvement Program (AMIP) Management Office (AMMO) systems research and planning efforts required as part of the development of a new family of Army models. Command and control can be thought of as large complex system of facilities, equipment, communications, procedures, and personnel through which command and control of forces and resources is exercised in performing the missions and functions assigned to them. Modeling C2 provides a means of analyzing the process and the effects of alternative doctrine, tactics, and C2 systems. The size and complexity of the command and control decision process make it difficult to model; simulation is one means of making the modeling problem tractable. The objective of this effort was to develop and evaluate design concepts for modeling command and control on the hypercube parallel processing computer architecture using the associated Time Warp operating system. In particular, the evaluation was to be responsive to two basic questions: Can Time Warp on a hypercub e architecture be used in conjunction with object-oriented techniques to significantly speed up the processing time associated with command and control modeling? GRA

N86-27525# Rome Air Development Center, Griffiss AFB, N.Y.
PROCEEDINGS OF THE 1985 ANTENNA APPLICATIONS SYMPOSIUM, VOLUME 2
Dec. 1985 372 p Conference held in Monticello, Ill., 18-20 Sept. 1985
(AD-A165535; RADC-TR-85-242-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 09/5

The Proceedings of the 1985 Antenna Applications Symposium is a collection of state-of-the-art papers relating to phased array antennas, multibeam antennas, satellite antennas, microstrip antennas, reflector antennas, HF, VHF, UHF, and various other antennas. GRA

N86-27526# Department of the Navy, Washington, D. C.
A PARTIALLY ADAPTIVE ARRAY USING BOOTLACE LENS Patent Application
William F. Gabriel and James K. Hsiao, inventors (to Navy) Filed 11 Oct. 1985 17 p
(AD-D012183; US-Patent-Appl-SN-786569) Avail: NTIS HC A02/MF A01 CSCL 17/4

A partially adaptive array compensates for jamming. The array is comprised of more than 1000 elements and uses a bootlace lens to form a family of beams from which an adaptive array chooses at least one beam of the family of beams that most clósely represent the jamming, and subtracts the beam from a main beam. In this way jamming of the main beam is compensated for. Author (GRA)

N86-27527# Lawrence Livermore National Lab., Calif.
RADAR CROSS SECTION REDUCTION BY LUMPED, LINEAR, PASSIVE LOADING
R. M. Bevensee Oct. 1985 6 p Presented at the IEEE National Radar Conference, Los Angeles, Calif., 12 Mar. 1986
(Contract W-7405-eng-48)
(DE86-002855; UCRL-93545; CONF-860347-1) Avail: NTIS HC A02/MF A01

A general analysis describing total power scattered from lossy, electrically linear bodies of arbitrary shape, excited by single-frequency plane waves, is modified to treat bistatic scattered power, p(sub sc), in a specified solid angle. Formulas are given for the passive load at a selected port to minimize p(sub sc) in terms of four real radiation field parameters and the input impedance. The analysis is illustrated for a thin-wire aircraft model, lambda/2 long. p(sub sc) in a 60 deg. cone is first minimized for nose-on incidence of a circularly-polarized wave, and then reduced for many incident waves by lumped loading at two ports. An iterative scheme was employed to converge on the loads. Even the simple loading scheme employed reduced p(sub sc) by at least 12.8 dB for each of the 56 directions of incidence within the 60 deg. scatter cone. DOE

N86-27528# National Telecommunications and Information Administration, Boulder, Colo. Inst. for Telecommunication Sciences.
MILLIMETER-WAVE BEHAVIOR OF RAIN ATTENUATION BASED ON RECENT EXPERIMENTAL DATA
E. J. Dutton Jan. 1986 42 p
(PB86-166907; NTIA-86-189) Avail: NTIS HC A03/MF A01 CSCL 20N

The report describes analysis of millimeter-wave data taken over the last year or so (1984-1985) by the Institute for Telecommunication Sciences. The first part of the report reviews multiple-frequency analysis and discusses problems encountered in applying these techniques to the 28.8, 57.6, and 96.1 GHz frequency specific rain attenuation data taken in the ITS experiment. The report then examines two alternative ways of using the ITS experimental data to predict specific rain attenuation and its annual occurrence. First, power-law fitting techniques to the data are discussed and compared. Next, a model for the prediction of annual worst-case specific rain attenuation is evolved to more directly aid in engineering design. This model is derived from a sample of daily specific rain attenuation distributions at Gasquet and is referred to as the standard sample. The worst-case results obtained from the standard sample are then compared with some more-recent data from Gasquet, California. GRA

N86-27529# Institute for Telecommunication Sciences, Boulder, Colø.
RAIN ATTENUATION MEASUREMENTS AT 28.8, 57.6, AND 96.1 GHz ON A 1-km PATH
R. H. Esperland, E. J. Violette, and K. C. Allen Feb. 1986 42 p
(PB86-175569; NTIA-86-190) Avail: NTIS HC A03/MF A01 CSCL 20N

An experimental millimeter-wave propagation link was installed on a 1-km path in the northern California area (Gasquet) to compare rain rate and attenuation at 28.8,57.6, and 96.1 GHz. During the monitoring period (January 26 through April 14), rain occurred on 27 days with an accumulation of 514 mm (20.25 in). For periods when the rain rate exceeded 5 mm/h, both VV (vertical polarization at the transmitter and vertical polarization at the receiver) and VH

(vertical polarization at the transmitter and horizontal polarization at the receiver) signals were recorded. Maximum rain rates exceeded 50mm/h and maximum attenuations of 4, 10, and 17 dB were observed on the 28.8, 57.6, and 96.1 GHz channels, respectively. GRA

N86-27530# Federal Communications Commission, Washington, D. C. Office of Engineering and Technology.
MODERN METHODS FOR CALCULATING GROUND-WAVE FIELD STRENGTH OVER A SMOOTH SPHERICAL EARTH
R. P. Eckert Feb. 1986 48 p
(PB86-173457; FCC/OET/R86-1) Avail: NTIS HC A03/MF A01 CSCL 20N

The report makes available the computer program that produces the proposed new FCC ground-wave propagation prediction curves for the new band of standard broadcast frequencies between 1605 and 1705 kHz. The curves are included in recommendations to the U.S. Department of State in preparation for an International Telecommunication Union Radio Conference. The history of the FCC curves is traced from the early 1930's, when the Federal Radio Commission and later the FFC faced an intensifying need for technical information concerning interference distances. A family of curves satisfactorily meeting this need was published in 1940. The FCC reexamined the matter recently in connection with the planned expansion of the AM broadcast band, and the resulting new curves are a precise representation of the mathematical theory. Mathematical background is furnished so that the computer program can be critically evaluated. This will be particularly valuable to persons implementing the program on other computers or adapting it for special applications. Technical references are identified for each of the formulas used by the program, and the history of the development of mathematical methods is outlined. Author

N86-27531# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Electromagnetic Wave Propagation Panel.
PROPAGATION EFFECTS ON MILITARY SYSTEMS IN THE HIGH LATITUDE REGION
Haim Soicher, ed. (Army Communications-Electronics Command, Fort Monmouth, N.J.) Loughton, England Nov. 1985 577 p Proceedings of the 36th Symposium of the Electromagnetic Wave Propagation Panel, Fairbanks, Alaska, 3-7 Jun. 1985
(AGARD-CP-382; ISBN-92-835-0383-X) Avail: NTIS HC A25/MF A01

Various topics relative to propagation effects on military systems at high latitudes are discussed. Ionospheric propagation, propagation aspects of high frequency communication, high altitude probes, scattering, measurement techniques, and meteor scatter radio communication are among the topics covered. For individual titles, see N86-27532 through N86-27565.

N86-27532# Alaska Univ., Fairbanks. Geophysical Inst.
SOLAR-TERRESTRIAL RELATIONSHIPS IN THE HIGH LATITUDE REGION c46
S.-I. Akasofu *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 17 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

It is shown how the magnetosphere responds to the three components (B sux x, B sub y, B sub z) of the interplanetary magnetic field (IMF) and to the power sigma of the solar wind magnetosphere dynamo. In particular, it is shown that the geometry of the auroral oval and the polar cap depends greatly on the magnitude and signs of the IMF three components. Geomagnetic storms result when the dynamo power sigma exceeds approx. 1 million Mwatts. Once such knowledge is available, it is possible to predict the geometry of the auroral oval and the intensity of a geomagnetic storm as a function of time, if one can predict time variations of the solar wind speed and the IMF three components. We demonstrate such a possibility by a computer model study, namely by the first generation numerical forecasting scheme. Author

N86-27533# Norwegian Defence Research Establishment, Kjeller.
MEDIA EFFECTS ON SYSTEMS IN THE HIGH LATITUDE REGION
E. V. Thrane *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 16 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

The effects of the transmission medium on radio systems in the high latitude regions are reviewed. First, some general properties of propagation media are discussed, followed by brief descriptions of the effects on radio waves of the Earth's surface, the troposphere and the ionosphere in high latitudes. General principles are illustrated by examples from observations and model calculations. Author

N86-27534# Physical Dynamics Northwest, Bellevue, Wash.
RECENT HILAT RESULTS
E. J. Fremouw *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 14 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

The Defense Nuclear Agency (DNA) HiLat Satellite was launched on 27 June 1983 for the purpose of studying the development and dynamics of F-layer irregularities between the plasmapause and the pole. In a circular 800-km orbit at 82 inclination, it carries (1) a coherent radio beacon for measuring complex-signal scintillation and TEC, (2) a three-instrument thermal-plasma experiment consisting of a Langmuiare probe (debilitated on launch), a retarding-potential analyzer (RPA), and an ion drift meter; (3) an energetic-electron spectrometer operating between 20 ev and 20 kev, (4) a three-axis fluxgate magnetometer, and (5) an optical package consisting of a vacuum-ultraviolet (vuv) imaging spectrophometer (failed after collecting forty orbits of data) and two visible-wavelength telephotometers. All instruments other than the Langmuire probe and the vuv imager continue to operate reliably. To date, HiLat has returned the following three specific observations of note: first auroral image in full daylight, most intense field-aligned current flowing into the ionsophere, and energy-dispersed electron precipitation impulses with about a one-second periodicity. These observations and on-going analyses of HiLat's bulk data base are summarized. Author

N86-27535# Air Force Geophysics Lab., Hanscom AFB, Mass. Ionospheric Physics Div.
TOTAL ELECTRON CONTENT AND L-BAND AMPLITUDE AND PHASE SCINTILLATION MEASUREMENTS IN THE POLAR CAP IONOSPHERE
J. A. Klobuchar, G. J. Bishop, and P. H. Doherty (Emmanuel Coll., Boston, Mass.) *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 8 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

The first measurements of absolute Total Electron Content (TEC) and L-band amplitude and phase scintillation were made from Thule, Greenland, a polar cap station, in early 1984. These measurements were made using signals transmitted from the Global Positioning System (GPS) satellites. The variability of the TEC, especially during the afternoon to pre-midnight hours, is large, with increases in TEC above the background values of greater than 100 percent not uncommon. During one disturbed time quasi-periodic TEC enhancements having periods as short as ten minutes and amplitudes equal to the background TEC were observed for over two hours. The TEC during some of the disturbed periods in the dark Thule ionosphere exceeded mid-latitude daytime values. Amplitude scintillations were small, not exceeding 3 dB peak to peak during the entire observing period, but they were associated with the times of TEC enhancements, with some evidence for stronger scintillation occurring during the negative gradients of the TEC enhancements. Phase scintillations were highest during some of the times of enhanced TEC, and depend critically upon the phase detrend interval used. Author

N86-27536# Army Communications-Electronics Command, Fort Monmouth, N.J. Center for Communications Systems.
VARIABILITY OF TRANSIONOSPHERIC SIGNAL TIME DELAY AT HIGH LATITUDES NEAR SOLAR MINIMUM
Haim Soicher *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 9 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

Faraday observations were conducted at Anchorage, Alaska (61.04 degrees N, 149.75 degrees W) utilizing beacon transmissions from a geostationary satellite during the period just following the minimum phase of solar cycle 21. Average maximum monthly values of total electron content (TEC), which is proportional to transionospheric signal time delay, were below 15 x 10 to the 16th power el m-2, while individual daily maximum values never exceeded 20 x 10 to the 16th power m-2. Seasonal and day-to-day variabilities were observed. Unique representation of the data has permitted the study of day-to-day variability of TEC. For example, during all seasons the TEC structure appears uniform from day to day during the buildup and decay phase of the local ionosphere. During the maximum and minimum of the diurnal phase, the TEC structure variability is seasonally dependent. During periods of magnetic sudden commencements, which rarely occurred in the observations period, significant positive phase response of TEC did not materialize. Author

N86-27537# Boston Univ., Mass. Dept. of Astronomy.
F LAYER IRREGULARITIES AT PLASMAPAUSE AND AURORAL LATITUDES **c46**
Jules Aarons *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 16 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

Distinctive effects of two irregularity regions, one at plasmapause latitudes and the second in the auroral region, were explored using primarily radio scintillation data. Using scintillation measurements at the times numbering seven to nine sensors within a relatively confined area, it is possible to document the morphology of development of irregularities in the plasmapause and in the auroral region over a period of time, a technique difficult with only low altitude satellite scintillation observations. Two cases of irregularity storms one in the plasmapause and the second in the auroral oval are reported. During the stable auroral red arc of March 5 to 6, 1981, intense irregularities were centered at plasmapause latitudes but levels tapered off in the same longitude sector at auroral latitudes. Reported Synthetic Aperture Radar (SAR) measurements indicated no visible aurora until areas 4 L shells polewards. Low energy (approx. 8ev) electron precipitation has been reported within the region covered by the SAR arcs. Higher temperatures have also been reported within the SAR arc, perhaps indicating a need to invoke the temperature gradient drift instability as the source for the generation of irregularities. Scintillation of moderate level is not uncommon for the plasmapause region. In March 1981 approximately 60% of the nights had scintillation levels approx. 6 dB at 137 MHz lasting over one hour. Author

N86-27538# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Avionics Lab.
INFLUENCE OF IONOSPHERIC IRREGULARITY SHAPE AND VELOCITY ON THE DESIGN OF AIRBORNE SATELLITE COMMUNICATIONS SYSTEMS
Allen L. Johnson *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 10 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

Extensive ground and airborne UHF ionospheric scintillation measurements were conducted in the polar region during the peak of the current solar cycle. Using three spaced antennas the speed and direction of the irregularity drift was obtained from cross-correlation plots. Measurements taken during 1980 at Thule, Greenland; Sonderstrom, Greenland, and Goosebay, Labrador showed velocities of up to s1000 meters per second. A diurnal pattern of rapid direction changes provided information on the two cell polar circulation of the irregularities from the noon sector of the auroral oval over the polar cap to the midnight section and back around the oval to the noon section. Airborne ionospheric scintillation fading measurements conducted near Goosebay were compared with simultaneous ground measurements to investigate the ionospheric irregularity shape. Polar ionospheric scintillation fading measurement indicates that special care is required in the design of airborne satellite communications systems intended for polar operation. Applicable coding techniques, interleaving length, modulation schemes, and message length to provide an airborne satellite communication system protection against polar ionospheric scintillation fading are discussed. Author

N86-27539# SRI International Corp., Menlo Park, Calif.
PROPAGATION EFFECTS ON SATELLITE-BORNE SYNTHETIC APERTURE RADARS Abstract Only
Charles L. Rino and Jacqueline Owen *In* AGARD Propagation Effects on Military Systems in the High Latitutde Region Nov. 1985 1 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

A numerical Synthetic Aperture Radar (SAR) simulator is discussed. The simulator can generate and process image segments with full or partial corrections for range walk and quadratic phase-error correction. The simulations also include the effects of coherent target speckle, which is important in assessing SAR image quality. Results show that moderate auroral-zone scintillation will degrade an image to about the same level as any undisturbed image processed with only partial range-walk compensation. Thus, propagation effects are undoubtedly present in many of the SEASAT-A high-latitude images, but the degradation is comparable to other distortions introduced in the processing itself. Phase error compensation is effective, but amplitude scintillation is also important for larger disturbances. Ramifications of SAR imaging are discussed. Author

N86-27540# University Coll. of Wales, Aberystwyth.
HIGH-LATITUTDE SCINTILLATIONS USING NNSS SATELLITES
L. Kersley *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 7 p (For primary document see N86-27531 18-32)
(Grant AF-AFOSR-0037-84)
Avail: NTIS HC A25/MF A01

An experiment is described which has been established in Northern Sweden since September 1984 to monitor scintillations using transmissions from NNSS satellites. Designed for long-term nearly-unattended operation, with control and data handling based around a PDP 11/23 minicomputer, the equipment records and processes data from more than 20 NNSS passes per day. Stored on magnetic tape for further study for each 20s segment of received signal after suitable detrending, are S4-indices for both frequencies, the r.m.s. differential phase fluctuations, the differential phase rotation (differential doppler), together with statistics of signal fading below selected thresholds and durations of individual fades. Determination of satellite position in nearly-real time from the transmitted ephemeris parameters enables estimates of effective ionospheric irregularity height to be made for high-elevation passes by means of the cross correlation of signals received on two separated antennas. A second mode of operation allows the raw data to be stored for subsequent analysis. This has been used successfully for coordinated special program experiments in conjunction with the EISCAT ionospheric radar facility in the study of the physical processes reponsible for the scintillation-producing irregularities. Author

N86-27541# Mitre Corp., Bedford, Mass.
SHF/EHF RAY BENDING
D. L. Zimmerman, G. F. Providakes, D. L. Post, and S. H. Talbot (Rome Air Development Center, Griffiss AFB, N.Y.) *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 6 p Sponsored in part by AF (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

Ray bending expected for narrow-beam satellite links in the atmosphere are discussed. Satellite communications terminals in the upper latitudes frequently operate at low elevation angles with high gain antennas. These antennas produce narrow beams that pass through the atmosphere at low terminal-to-satellite evaluation angles for communication with geostationary equatorial satellites. The propagation paths experience ray bending caused by earth curvature and a decrease in atmospheric refractivity with altitude. Unless these effects are properly accounted for, acquisition and tracking problems can occur. Ray bending was found to vary from about 0.1 degrees for 10 degrees elevation angles to about 0.75 degrees for 0 degrees elevation angles under standard atmospheric conditions. Bending was found to be nearly independent of frequency in the SHF/EHF (20 GHz to 50 GHz) region. Warm high-humidity areas tended to produce more bending. Potential problem areas, including tracking and spatial acquisition, are discussed for satellite systems. The authors propose using elliptic reflectors and analytic prediction of ray bending to minimize adverse effects of ray bending. Author

N86-27542# Communications Research Centre, Ottawa (Ontario).
E.H.F. PROPAGATION MEASUREMENTS ALONG SATELLITE-EARTH PATHS IN THE CANADIAN HIGH ARCTIC
I. Lam and J. I. Strickland *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 8 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

Observations of the signal received from an EHF satellite beacon were made during June, August and December 1984 from a location in the Canadian arctic north of 80 deg N. The satellite follows an inclined orbit and as a result is visible for about eleven hours per day. During this period the elevation angle to the satellite varies between zero and approximately 21 degrees. The pointing of the receive antenna towards the satellite was achieved through computer-controlled tracking with a resolution better than 5% of the antenna beamwidth. Throughout the experimental period the changes in atmospheric conditions were mainly due to movement of air masses rather than diurnal variations in ground heating. Also, even though fog from the nearly ocean occurred frequently, there were no significant amounts of precipitation during the experiment. The results of the experiment indicate that signal fading occurs almost entirely at elevation angles less than approximately 5 degrees. Variations in the median signal level are presented as a function of the elevation angle. Also included are cumulative distributions of received signal level computed for various elevation angles. In general, the experimental results correlate well with the atmospheric conditions. The fading was found to be less severe in the winter than either spring or summer. Author

N86-27543# GEC-Marconi Electronics Ltd., Chelmsford (England).
IONOSPHERIC MODELLING AND HF RADIO SYSTEMS AT HIGH LATITUDES
S. Quegan, J. D. Milsom, and R. N. Herring *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 8 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

Successful planning of HF radio systems to operate at high latitudes requires some means of predicting ionospheric morphology, both as regards ambient electron density and ionospheric irregularities causing backscatter. Because of the presence of several physical processes, and the sparsity of data, reliable statistical models are not easily constructed. However, increasing knowledge of the processes operating, and the availability of powerful computers, makes the construction of physically-based numerical models of ionospheric structure a viable proposition. Such a model at a fairly advanced stage of development is described. Examples of calculated electron densities are given. The ingredients and shortcomings of the model are be described, together with the steps to be taken to account for ionospheric irregularities, and to allow us to predict HF system performance using ray-tracing. Author

N86-27544# Rome Air Development Center, Hanscom AFB, Mass. Electromagnetic Sciences Div.
HIGH LATITUDE SPATIALLY ADAPTIVE PROPAGATION EXPERIMENT
Gary S. Sales, Raymond J. Cormier, Raymond A. Greenwald (Johns Hopkins Univ., Laurel, Md.), and Kile B. Baker *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 7 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

A special HF phased array was used to obtain high latitude HF propagation data. The antenna located at Goose Bay, Labrador, Canada, received HF transmission (8 to 20 MHz) from Thule, Greenland. The receiving antenna at Goose Bay consisted of two parallel linear arrays each with 16 horizontal log-periodic antennas. This system was used to measure both the azimuth and elevation angle of arrival of the propagated radio wave. Comparisons are made with model calculations and the received modes are analyzed to determine the presence of ionospheric tilts. Author

N86-27545# York Univ. (England). Dept. of Electronics.
TECHNIQUES FOR IMPROVING THE RELIABILITY OF MOBILE HF COMMUNICATIONS OVER HIGH-ABSORPTION PATHS
M. Darnell *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 15 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

System design aspects of the mobile HF communications problem in high-latitude regions are discussed. An attempt is made to identify the various techniques available for enhanced reliability of reception under high-absorption conditions and to indicate how these can be coalesced into an improved HF system design. The basic problem associated with excess absorption is that received signal-to-noise ratios (SNR's) are lower than those which might be expected for say mid-latitude paths. Specific methods by which the value of the SNR required at the receiver can be reduced, either directly or effectively are discussed. Techniques discussed include: (1) the use of various forms of diversity processing, emphasising the value of path/geographical diversity combining; (2) relaying out of the disturbed region with a view to avoiding the perturbed ionosphere and operating the transmitting antenna system more efficiently at a high frequency; (3) the use of meteor-burst and ionospheric scatter communication to complement normal HF communication; (4) the use of modulation and coding schemes requiring a relatively low SNR at the receiver; and (5) system control procedures. Author

N86-27546# Alaska Univ., Fairbanks. Geophysical Inst.
PROPAGATION CHARACTERISTICS OF MEDIUM FREQUENCY SKYWAVE SIGNALS FROM THE CONTINENTAL US AND CANADA RECEIVED AT FAIRBANKS, ALASKA
Robert D. Hunsucker, Brett S. Delana, and John C. H. Wang *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 14 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

Since September 1981, an F.C.C.-sponsored medium-frequency (MF) skywave monitoring program has been in continuous operation at the Geophysical Institute of the University of Alaska. The receiver frequency is automatically stepped through 16 channels every five minutes by the system programmer. Recordings are continuously made of ten or more standard broadcast stations on digital tape cassettes, which are then transferred on a weekly basis to form a data base on a VAX 11/780-785 computer. A noise source has also been provided for system calibration. Three antennas have been utilized during the program to date, a 32-meter top-loaded vertical with ground screen being the primary antenna. Measurements of the electrical characteristics and computer modeling of the antenna systems have been made, and selected results are presented, as well as daily, seasonal and sunspot variation effects on measured MF skywave signal strengths. The summer/winter and magnetic activity effects are profound on medium and long-distance paths to

Fairbanks. Present plans are to continue this monitoring program until Fall 1987 at least half of a sunspot cycle. Author

N86-27547# Paris-Sud Univ., Cachan (France). Lab. d'Etude des Transmissions Ionospheriques.

OPTIMISATION DES SYSTEMS OF TRANSMISSION NUMERIQUE TRANSAURORAUX EN ONDES DECAMETRIQUES OPTIMIZATION OF H.F. DIGITAL RADIO SYSTEMS AT HIGH LATITUDES

C. Goutelard, J. Caratori, and A. Nehme *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 18 p In FRENCH; ENGLISH summary (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

High latitudes are inevitably encountered in telecommunications, especially in long distance transmissions. At high latitudes the following phenomena appear: auroral and polar absorptions, spread F, perturbations aligned with the magnetic field, sporadic E... which make long distance transmission characteristics special. Researchers were able to establish a channel model from experimental observations of transmissions travelling through high latitudinal regions. The parameters of the model must include the perturbations found at high latitudes, the length of the transmission, and its position relative to the magnetic pole and the auroral zone. From these models, which point out the spectral modifications of the signal, the fading, the duration of coherence, researchers determined the classes of signals which can be needed for H.F. digital telecommunications with the aim of diverse techniques: serial or parallel transmissions, autoadaptative systems, coded transmission systems. Author

N86-27548# Forschungsinstitut der Deutschen Bundespost, Darmstadt (West Germany).

OBSERVATIONS WITH AN IONOSONDE IN NORTHERN GERMANY NEAR THE MID-LATITUDE TROUGH c46

Thomas Damboldt *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 5 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

A new-vertical incidence ionosonde was installed more than two years ago near Hamburg, in order to improve HF propagation predictions and frequency management. HF propagation in the North-Sea and Baltic-Sea areas - close to the auroral zone, near the mid-latitude trough - is highly variable. This manifests itself also on the ionograms. Many of them show peculiarities normally not seen farther south. The day-to-day variation of measured ionospheric characteristics is compared with those obtained by the CCIR method (Report 340). In addition statistics of ionospherically disturbed days in the years 1983 and 1984 are given and compared with measurements of the variations of the geomagnetic field at the near-by observatory Wingst. Although the ionosonde is used mainly as a tool for up-to-date HF propagation predictions, the collected data can be of considerable use also for the design of new HF radio systems in the area under consideration. Author

N86-27549# Rutherford High Energy Lab., Chilton (England).

IONOSPHERIC FACTORS AFFECTING THE PERFORMANCE OF HF SKY-WAVE SEA-STATE RADARS AT HIGH LATITUDES

P. A. Bradley, A. J. Gibson, J. C. Schlobohm (SRI International Corp., Menlo Park, Calif.), and D. E. Westover *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 14 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

Sky-wave radars provide a means of ocean surveillance beyond line of sight and beyond the ranges achievable with a ground-wave radar. However, the ionosphere introduces a number of important propagation limitations. Firstly, it is necessary to provide illumination of the areas of interest, which may place restrictions on radar sitting and periods of operation. Then, backscattered signals must have sufficient amplitude to provide adequate discrimination above the naturally occurring and interference backgrounds. A radar measures time-of-flight and such information needs transforming to equivalent ground range in terms of the prevailing ionospheric path. Finally, ionospheric motions create Doppler shifts and spreads of the returned signals which prevent spectral resolution of Bragg scattered components. The high-latitude ionosphere is characterised by features which exhibit marked spatial and temporal variability. Specific problems are discussed and possible ways of alleviating some of these considered. Author

N86-27550# Paris VI Univ. (France).

SPECTRAL CHARACTERISTICS OF HIGH FREQUENCY WAVES BACKSCATTERED BY SMALL SCALE F REGION IRREGULARITIES: EVIDENCE OF STRONG SUB-AURORAL ION FLOW

A. Bourdillon *In* AGARD Propagation Effects on Military Systems in the High Latitude Regin Nov. 1985 16 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

The spectra of H.F. waves backscattered at night by small scale (10 to 20 m) sub-auroral F region irregularities often exhibit large Doppler shifts and widths in the local time sector 2000 to 2400. After local midnight the Doppler shifts and the widths of the spectra decrease rapidly. Examples of experimental data obtained with the two coherent backscatter radars of the EDIA experiment, showing the spectral characteristics just mentioned are given. From the Doppler shift measured at the two sites researchers deduced the perpendicular velocity of the irregularities, which can reach values as high as 2000 m/s. These observations are interpreted using results of theoretical models which predict strong sub-auroral ion flow in the trough region. Author

N86-27551# Toulon Univ. (France). Lab. de Sondages Electromagnetiques de l'Environment.

SMALL-SCALE IRREGULARITIES IN THE HIGH-LATITUDE F REGION c46

C. Hanuise, J. P. Villain, C. Beghin (Centre National de la Recherche Scientifique, Orleans, France), and G. Caudal (Centre National de la Recherche Scientifique, Saint-Maur-des-Fosses, France) *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 12 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

Coordinated observations performed at high and very high latitudes in the European sector with the ISOPROBE experiment on board the AUREOL 3 satellite, the EISCAT incoherent scatter radar and the SAFARI HF coherent radar system are reported. The latitudinal profiles of electron density measured by the incoherent scatter radar are used to determine the influence of the propagation of the HF radio wave on the detectability of the density variations deduced from in-situ measurements. The physical processes leading to the formation of the fluctuations are studied at several wavelengths from in-situ and radar data. The phase velocity vector constructed from the radial velocities measured by two HF radars are compared to the plasma drift measured with the EISCAT facility under various geophysical conditions. The excellent agreement between the estimates confirms, as predicted theoretically, that the F-region small-scale irregularities are drifting with the bulk plasma. Their motion can therefore can therefore be used to derive the two-dimensional flow pattern of plasma convection in the auroral and polar ionosphere. Author

N86-27552# SRI International Corp., Menlo Park, Calif. Radio Physics Lab.

ON THE RELATIONSHIP OF F-REGION STRUCTURE IN THE DAYSIDE AURORAL OVAL TO HF BACKSCATTER SIGNATURES ATTRIBUTED TO THE POLAR CUSP c46

J. D. Kelly, R. T. Tsunoda, J. K. Olesen (Danish Meteorological Inst., Copenhagen.), and P. Stauning *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 10 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

Ionosonde measurements in the vicinity of the dayside auroral oval are characterized by complex signal returns. These are thought to be associated with the structure of the electron density in the F-region attributed to processes associated with the polar cusp.

The results of a comparison of simultaneous, incherent-scatter radar measurements and ionosonde measurements of the dayside auroral-zone ionization are given. This experiment takes advantage of the unique geometry of the Sondrestrom radar operated by SRI International at Sondre Stromfjord, Greenland, and the ionosondes operated by the Danish Meteorological Institute at Godhavn and Sondre Stromfjord, Greenland. The radar was operated while the antenna scanned in the magnetic meridian. The locations of the ionosondes are in that meridian. The radar data greatly assist in the interpretation of the complex ionograms. The F-region structure in electron density is closely associated with specific features in the plasma convection patterns. The F-region structure associated with the plasma convection reversal (polar-cap boundary) in the postnoon sector and its ionogram signature were studied. The ionograms are charact erized by oblique echoes when the convection reversal is either poleward or equatorward of the ionosonde. The radar data indicate that the gradient in the electron density enhancement is similar on the poleward and equatorward edges, and that the enhancement is extended along the convection reversal for many hours. Author

N86-27553# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.

OBSERVATIONS OF VERY HIGH LATITUTDE IONOSPHERIC IRREGULARITIES WITH THE GOOD BAY HF RADAR c46

R. A. Greenwald and K. B. Baker *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 17 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

The Goose Bay HF radar is a sophisticated instrument capableof providing detailed information on very high latitude E and F region ionospheric electron density irregularities which act as a source of clutter on OTH radar systems. Through the use of two parallel phased array antennas, this instrument is able to image the ocation of these irregularities within a three-dimensional volume covering much of northeastern Canada and Greenland. It is also capable of following the temporal variability of these irregularities as well as determining unambiguously the Doppler shift and broadening of radar signals scattered by them. Initial results with a single phased array antenna which represent typical examples of the spatial intensity distribution of these irregularities at different local times are presented. Examples of Doppler spectra of the irregularities at different local times are given. Data of this type are of appreciable value in ascertaining the techniques that must be utilized to improve clutter mitigation on high latitude radar systems. Author

N86-27554# Utah State Univ., Logan. Center for Atmospheric and Space Sciences.

OBSERVATIONS OF THE MID-LATITUDE IONOSPHERIC TROUGH FROM ANTARCTICA c46

F. T. Berkey and M. J. Jarvis (British Antarctic Survey, Cambridge (England).) *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 25 p (For primary document see N86-27531 18-32)

(Grants NSF DPP-81-00220; NSF DPP-83-08044)

Avail: NTIS HC A25/MF A01

Measurements of the ionosphere using two identical digitally controlled high frequency radar systems have been conducted in the Antarctic from the Halley and Siple Stations. These stations are uniquely sited, both having essentially identical coordinates of geographic and geomagnetic latitude. Furthermore, due to the large offset of the geographic and magnetic poles in Antarctica, the difference in magnetic local time is less than half the separation in local solar time. The locations of the minimum and poleward edge of the trough have been found for magnetically quiet intervals and mapped into invariant latitude. Simultaneous measurements of the trough location from Siple and Halley have been compared using magnetic, local and universal time coordinates. For geomagnetically quiet conditions, this analysis suggests that the invariant latitude of the poleward edge has a Universal Time dependence prior to local midnight. The presence of the ionospheric trough introduces a further degree of complexity to the subauroral ionosphere which, in turn, complicates automatic realtime processing of digital ionograms. Several examples of a technique termed elevation angle filtering are presented and the effect of the presence of the ionospheric trough on this process is examined. Author

N86-27555# British Antarctic Survey, Cambridge (England).

THE VARIABILITY AND PREDICTABILITY OF THE MAIN F-REGION TROUGH DETERMINED USING DIGITAL IONOSPHERIC SOUNDER DATA c46

Alan S. Rodger and John R. Dudeney *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 11 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

The main F-region (or mid-latitude) electron density trough occurs near lambda = 60 degrees and is associated with significant meridional gradients in electron concentration. Despite many satellite studies of the trough, the causes of the variability of its shape as a function of time, geomagnetic and solar activity is still poorly understood. This is illustrated by the large discrepancies between the various empirical formulae tht have been developed to estimate the trough latitude for specified geomagnetic conditions. These problems arise partly because satellite data cannot be used to differentiate adequately between spatial and temporal variations. In 1981, a new and powerful research tool for trough studies has become available. The observations from this equipment have significantly improved our understanding of several features of trough morphology and in particular the causes of some of the variability. The four aspects of this variability that are discussed here are the orientation of the poleward edge of the trough with respect to Halley; the variation of the maximum plasma frequency of the poleward edge; the signature of the Harang discontinuity in the poleward edge and the latitudinal movement of the poleward edge as a function of time and geomagnetic activity. A framework is described for incorporating these aspects of trough morphology into a realistic model for predicting the location and maximum plasma density of the poleward edge as a function of time and the prevailing geomagnetic conditions. Author

N86-27556# Alaska Univ., Fairbanks. Geophysical Inst.

PROGRESS IN MODELLING THE POLAR IONOSPHERE FROM SOLAR AND MAGNETOSPHERE PARAMETERS c46

B. J. Watkins, S.-I. Akasofu, and C. D. Fry *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 5 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

Solar and magnetospheric parameters have been used as inputs to a three dimensional ionospheric model covering the polar cap and auroral zone latitudes for heights 120 to 500 km. The development of this model is reported. Using solar and magnetosphere parameters, the solar radiation and convective electric field structure are defined. Solutions to the momentum and continuity equations for ionization densities are obtained vertically along magnetic field lines as they move under the influence of convective electric fields. The critical measurements that are needed to use such a model to predict ionospheric conditions at polar regions are discussed. Author

N86-27557# Lancaster Univ. (England). Dept. of Environmental Science.

STATISTICS OF AURORAL RADIO ABSORPTION IN RELATION TO PREDICTION MODELS

J. K. Hargreaves, M. T. Feeney, and C. J. Burns *In* AGARD Propagation Effects on Military System in the High Latitude Region Nov. 1985 10 p Sponsored in part by Royal Aircraft Establishment, Farnborough, England, and by the Science and Engineering Research Council (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

The prediction of HF propagation conditions at high latitude requires a knowledge of the statistics of radio absorption in the auroral ionosphere, a highly variable phenomenon depending on local time, magnetic latitude, season and solar activity. Data from riometer stations may be compiled to provide statistics on the

auroral radio absorption. Questions regarding the probability distribution and variations with latitude, solar and geomagnetic activity, and longitude are considered. Difficulties concerning the smallest absorption values are pointed out. Author

N86-27558*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Scien

FORMATION AND DETECTION OF HIGH LATITUDE IONOSPHERIC IRREGULARITIES **c46**

M. C. Lee, J. Buchau (Air Force Geophysics Lab., Hanscom AFB, Mass.), H. C. Carlson, Jr., J. A. Klobuchar, and E. J. Weber *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 14 p (For primary document see N86-27531 18-32)

(Grant NAG5-270; Contract F19628-83-K-0024)

Avail: NTIS HC A25/MF A01

Measurements of Total Electron Content (TEC) and airglow variations show that large scale plasma patches appearing in the high-latitude ionsophere have irregular structures evidenced by the satellite phase and amplitude scintillations. Whistler waves, intense quasi-DC electric field, and atmospheric gravity waves can become potential sources of various plamsa instabilities. The role of thermal effects in generating ionospheric irregularities by these sources is discussed. Meter-scale irregularities in the ionospheric E and F regions can be excited parametrically with lower hybrid waves by intense whistler waves. Ohmic dissipation of Pedersen current in the electron gas is able to create ionospheric F region irregularities in plasma blobs or plasma patches (i.e., high ambient plasma density environment) with broad scale lengths ranging from tens of meters to a few kilometers. Through the neutral-charged particle collisions, gravity waves can excite large-scale (less than tens of kilometers) ionospheric irregularities simultaneously with forced ion acoustic modes in the E region. The large-scale ionospheric density fluctuations produced in the E region can extend subsequently alogn the earth's magnetic field to the F region and the topside ionospheric regions. These mechanisms characterized by various thermal effects can contribute additively with other processes to the formation of ionospheric irregularities in the high latitude region. Author

N86-27559# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).

DIRECT, IN-SITU MEASUREMENTS OF IRREGULARITIES IN THE MESOSPHERE (85 - 50 km) AT 69 DEG N (ANDENES, NORWAY) **c46**

Hans-Ulrich Widdel *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 10 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

One of the problems of the physics of the mesosphere which is apparently not yet completely solved is which hydrodynamic mechanisms can cause transient vertical and horizontal gradients of electron density and neutral air density. Such gradients give rise to scattered signals of radio waves at different frequencies. Well-known are the 'partial echoes' observed on short wave frequencies below about 100 km down to about 60 km. They seem to occur at certain 'preferred' heights which seem to change with season and latitude. Because the distribution of ionization at such low altitudes, once produced, is primarily controlled by the neutral atmosphere. Investigations of the dynamics of the neutral atmosphere combined with simultaneous radio wave measurements promise some advance of knowledge. It was shown that small foil clouds, together with proper techniques of observation can be used to study in detail a number of dynamic effects in the neutral atmosphere with high spatial resolution. This high spatial resolution revealed that some atmospheric structures seem to be very local. Further, the radar range gate echo records showed that the radar tracking data do not always tell the full story. To obtain a better picture, more than one chaff target, separated in space, should be tracked simultaneously. This calls for a 3D-multiacquisition-multitarget radar for tracking. Author

N86-27560# Rome Air Development Center, Hanscom AFB, Mass.

CONDUCTIVITY PROFILES OF THE DISTURBED POLAR IONOSPHERE FROM VLF REFLECTION DATA

P. A. Kossey, J. E. Rasmussen, E. C. Field (Pacifica-Sierra Research Corp., Los Angeles, Calif.), and C. R. Warber *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 11 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

Two independent techniques are used to determine conductivity profiles of the lower polar ionosphere during a strong solar proton event (SPE). The first method inverts reflection coefficients measured with a groundbased VLF sounder; the second uses proton fluxes measured on board satellites to calculate ion-pair production rates, which, in turn, are input to lumped-parameter de-ionization equations. Conductivities determined by the two methods exceed ambient by two or more orders of magnitude, but disagree by up to an order of magnitude at altitudes between fifty and sixty kilometers. Full-wave calculations are used to predict the effect of the SPE-disturbed profiles on long range VLF propagation in the earth-ionosphere waveguide. The SPE is found to suppress the geomagnetically converted transverse electric field radiated by a groundbased vertical electric dipole. Author

N86-27561# Bonn Univ. (West Germany). Radioastronomical Inst.

A STUDY OF ULF PROPAGATION AT HIGH SOUTHERN LATITUDES USING SFERICS

H. Volland, M. Schmolders, G. Proelss, and H. Kroeninger (National Electrical Engineering Research Inst., Pretoria (South Africa).) *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 10 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

Sferics are electromagnetic pulses generated by lightning events. Their maximum spectrum energy is in the frequency range below 15 kHz. These powerful natural VLF transmitters can be used to determine the propagation characteristics of the atmospheric wave guide between earth and ionospheric D layer along virtually every propagation path. A VLF-sferics-analyzer was operating at the German antarctic Von Neumayer station from January to July 1983. This analyzer records sferics from distant ligntning events in the frequency range between 5 and 9 kHz. The method of measurement is described. The data of June 1983 are evaluated, and the distances of the sources are determined by a comparison with rainfall records during the same month and, in addition, with sferics recordings from a station in Pretoria, South Africa. The data evaluation of the propagation conditions is compared with theoretical calculations. The main result is that the virtual reflection height of the ionospheric D layer is between about 78 km at noon and about 84 km during midnight in reasonable agreement with the theory. The difference between west-to-east and east-to-west propagation is smaller than the theory predicts indicating that the ionospheric D layer at high souther latitudes behaves more isotropic with respect to VLF propagation than at mid-latitudes. Author

N86-27562# Pacifica-Sierra Research Corp., Los Angeles, Calif.

EFFECTS OF THE IONOSPHERE ON ELF SIGNALS DURING POLAR CAP ABSORPTION EVENTS: COMPARISON OF THEORY AND EXPERIMENTS

E. C. Field, C. R. Warber, and R. G. Joiner (Office of Naval Research, Arlington, Va.) *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 10 p (For primary document see N86-27531 18-32)

Avail: NTIS HC A25/MF A01

In order to calculate extremely low frequency (ELF) propagation when the earth-ionosphere waveguide is not stratified, a hybrid method is developed that uses full-wave theory to determine local parameters of the TEM mode, but uses ray theory to describe the field's horizontal variations. The method is applied to several model solar proton events (SPEs), including one based on the weak 23 November 1982 event. Calculations predict diminished fields near the Gulf of Alaska, where a submarine-borne receiver measured

an unusually severe signal reduction. That behavior is caused by lateral refraction, which bends the signal away from the polar cap boundary and into the central cap where, during an SPE, the phase velocity of the TEM mode is slowest. The theory also predicts an enhanced field just inside the polar cap boundary, but no data are available to test that result. Author

N86-27563# Norwegian Telecommunications Administration, Oslo.
WORLD ATLAS OF GROUND CONDUCTIVITIES WITH PARTICULAR EMPHASIS ON THE HIGH LATITUDE REGION
Knut N. Stokke *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 12 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

Methods of predicting the phase and amplitude of ground waves are discussed. An important feature concerning transmission of ground waves is the ground conductivity. Information about the ground conductivity has been, and is, important for the planning work in the International Telecommunication Union (ITU). Therefore very early in the work of IWP 5/1 the necessity of a ground conductivity atlas was recognized, and in 1978 the IWP 5/1 was formally given the task to produce a world atlas (CCIR Decision 3). Information about the ground conductivity has been received from about 50 countries, but there are some problems concerning the way in which the informations are presented. However, measuring campaigns will give better data and will also give better informations from other areas. The first edition of the Atlas is planned before the CCIR Final Studygroup Meetings September - November 1985. Author

N86-27564# Royal Aircraft Establishment, Farnborough (England).
METEOR SCATTER RADIO COMMUNICATION AT HIGH LATITUDES
P. S. Cannon, A. H. Dickson, and M. H. Armstrong *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 18 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

A brief historical and physical description of the meteor burst communications (MBC) technique is given together with a discussion of the advantages of very high frequency MBC, with respect to conventional high frequency communication, when used at high latitudes. A recently deployed high latitude MBC propagation experiment, between Bodo in Norway and Wick in Scotland (UK) is described and some of the early data gathered at frequencies close to 40 MHz and 70 MHz is presented. A theoretical description of the effects of Polarisation Rotation in a linearly polarised MBC system is developed and it is shown that at 40 MHz Polarisation Rotation, due to excess D-region ionization may cause the system performance to differ from its ambient level. Corroborative experimental results, over a temperature latitude path, are presented. Based upon the early high latitude experimental results and on the theoretical calculations, it is suggested that frequencies close to 40 MHz, in common use in atemperate latitude linearly polarised MBC systems, are too low for high latitude operation. Author

N86-27565# Danish Research Center for Applied Electronics, Hoersholm.
CHARACTERISTICS OF HIGH LATITUDE METEOR SCATTER PROPAGATION PARAMETERS OVER THE 45 - 104 MHz BAND
J. C. Ostergaard, J. E. Rasmussen, M. J. Sowa, J. M. Quinn, and P. A. Kossey *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 15 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

Data being acquired on a high latitude test-bed, to assess the performance of meteor scatter propagation over the 45 to 104 MHz band, are described. Emphasis is on data obtained over a 1200 km path in northern Greenland, which includes initial estimates of the availability of usable meteor trails, the potential performance of meteor scatter systems, and the application of adaptive data rates to improve system performance. The use of the data to validate and expand propagation prediction techniques for the polar region is also discussed. Author

N86-27566# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Electromagnetic Wave Propagation Panel.
PROPAGATION IMPACT ON MODERN HF COMMUNICATIONS SYSTEM DESIGN
Loughton, England Mar. 1986 187 p Lecture series held in Brussels, Belgium, 21-22 Apr. 1986; in Issy-les-Moulineaux, France, 24-25 Apr. 1986; and in Copenhagen, Denmark, 28-29 Apr. 1986 (AGARD-LS-145; ISBN-92-835-1521-8) Avail: NTIS HC A09/MF A01

AGARD Lecture Series 145 is concerned with high frequency communications and is sponsored by the Electromagnetic Wave Propagation Panel of AGARD and implemented by the Consultant and Exchange Program. The aim of these lectures is to survey problems in the field of HF Communications. The lectures cover needs of both the civil and military communities for high frequency communications. They discuss concepts of real time channel evaluation, system design, as well as advances in equipment, in propagation, and in coding and modulation techniques. The lectures are aimed to bring non-specialists in the field up to date so that HF communications can be considered as a viable technique at this time. The problems, difficulties and limitations of HF are also outlined. For individual titles, see N86-27567 through N86-27576.

N86-27567# Hull Univ. (England). Dept. of Electronic Engineering.
THE DESIGN OF STATIC AND MOBILE HF COMMUNICATION SYSTEMS
M. Darnell *In* AGARD Propagation Impact on Modern HF Communications System Design Mar. 1986 25 p (For primary document see N86-27566 18-32)
Avail: NTIS HC A09/MF A01

The lecture deals with more specific aspects of HF communication system design arising from a previous lecture entitled HF system design principles presented as part of AGARD Lecture Series 127 in 1983. The major topics considered are: (1) the design of point-to-point systems; (2) the design of systems involving mobile terminals; (3) system control and frequency management; (4) resistance to interception and disruption. The lecture is intended to provide a technical framework for later lectures covering the more detailed aspects of HF communication system design. Author

N86-27568# Norwegian Defence Research Establishment, Kjeller.
PROPAGATION 1: STATE OF THE ACT OF MODELLING AND PREDICTION IN HF PROPAGATION
E. V. Thrane *In* AGARD Propagation Impact on Modern HF Communications System Design Mar. 1986 21 p Previously announced as N83-30864 (For primary document see N86-27566 18-32)
Avail: NTIS HC A09/MF A01

The lecture reviews the state of the art in HF propagation modelling and describes the principles of radio frequency predictions. As a basis for the discussions, a brief introduction is given to the ionospheric parameters of importance to HF-propagation. Current methods for frequency prediction are semi-empirical, that is they depend upon a large data base of ionospheric physical models of the ionosphere and of radio wave propagation through the medium. In addition models of the noise and interference environment must be included. The lecture discusses the principles on which the methods are based, as well as their limitations. Examples are given of the use of predictions in system planning and communications. The relative importance of skywave and ground wave communications in the HF-band is discussed. Author

N86-27569# Hull Univ. (England). Dept. of Electronic Engineering.
EMBEDDED REAL-TIME CHANNEL EVALUATION TECHNIQUES

M. Darnell *In* AGARD Propagation Impact on Modern HF Communications System Design Mar. 1986 16 p (For primary document see N86-27566 18-32)
Avail: NTIS HC A09/MF A01

The requirement for real-time channel evaluation (RTCE) in HF systems is identified and discussed in detail. Various scenarios in which RTCE is applicable are examined and classified. Specific RTCE techniques and systems are then described including: Pulse/modulated pulse sounding, chirp sounding, limited channel monitoring, interference characterization, and in-band RTCE. The application of RTCE to practical HF systems is discussed and the benefits accruing from its use quantified. Author

N86-27570# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
AN INTRODUCTION TO ERROR-CONTROL CODING WITH APPLICATION TO HF COMMUNICATIONS
Mario D. Grossi *In* AGARD Propagation Impact on Modern HF Communications System Design Mar. 1986 16 p (For primary document see N86-27566 18-32)
Avail: NTIS HC A09/MF A01

The increasing demand for reliable, low error-rate, high-speed digital data transmission at HF has created the need for the adopting of coding schemes. As it is well appreciated by the practicing communicator, a problem in high-speed data transmission is the occurrence of errors. Codes provide an effective approach for the reduction of the error rate. Linear block codes (of which cyclic codes are a subclass) and convolutional codes are the main categories of codes of interest to HF communications. They are capable of correcting random errors due to white Gaussian noise, as well as burst errors due to impulse noise. In block codes, a block of information bits is followed immediately by a group of check bits. The latter verify the presence of errors in the former. In convolutional codes, check bits are continuously interleaved with information bits, and they check the presence of errors not only in the block immediately preceeding them, but in other blocks as well. For the various coding schemes reviewed in the lecture, several numerical examples are given, to help in the quantitative appraisal of the merits of a code, versus required equipment complexity. Author

N86-27571# Signatron, Inc., Lexington, Mass.
MODERN HF COMMUNICATIONS, MODULATION AND CODING
P. Monsen *In* AGARD Propagation Impact on Modern HF Communications System Design Mar. 1986 13 p Previously announced as N83-30867 (For primary document see N86-27566 18-32)
Avail: NTIS HC A09/MF A01

Digital communications over High Frequency radio channels are limited by the effects of time varying multipath signals and an impulsive noise characteristic. Modulation techniques which utilize adaptive receiver structures in conjunction with advanced error correction coding concepts can provide quality communication at both low data rates around 10 bps and high data rates around 2400 bps. The multipath channel is examined and two basic constraints are introduced. When the learning constraint is satisfied, it is possible to estimate the channel multipath gain and phase components. The diversity constraint establishes the necessary condition for implicit diversity. For low data rate applications where Intersymbol Interference (ISI) is negligible, adaptive receivers are discussed when both learning and diversity constraints are satisfied. An incoherent adaptive receiver is discussed for applications where the learning constraint is not satisfied. For high data rate applications, both constraints are satisfied in an HF application but ISI effects are severe. Adaptive techniques including equalizers and maximum likelihood sequence estimators are discussed. Experimental results from HF channel simulator tests are presented in a comparison of nonadaptive and adaptive high speed modems. We discuss the use of error correction coding to protect against impulsive noise and show that multipath fading reduces the theoretical performance capability by only 1 to 3 dB when proper coding and interleaving are employed. Performance of practical coding schemes using channel state information are used to show the potential performance on an HF channel. Author

N86-27572# Petrie Telecommunications, Nepean (Ontario).
EQUIPMENT: ANTENNA SYSTEMS
L. E. Petrie *In* AGARD Propagation Impact on Modern HF Communications System Design Mar. 1986 5 p Previously announced as N83-30868 (For primary document see N86-27566 18-32)
Avail: NTIS HC A09/MF A01

Some antenna fundamentals as well as definitions of the principal terms used in antenna engineering are described. Methods are presented for determining the desired antenna radiation patterns for HF communication circuit or service area. Sources for obtaining or computing radiation pattern information are outlined. Comparisons are presented between the measured and computed radiation patterns. The effect of the properties of the ground on the antenna gain and the pattern are illustrated for several types of antennas. Numerous examples are given of the radiation patterns for typical antennas used on short, intermediate and long distance circuits for both mobile and fixed service operations. The application of adaptive antenna arrays and active antennas in modern HF communication systems are briefly reviewed. Author

N86-27573# Mitre Corp., Bedford, Mass.
DEVELOPMENTS IN HF EQUIPMENT AND SYSTEMS MOBILE AND PORTABLE TERMINALS
Q. C. Wilson *In* AGARD Propagation Impact on Modern HF Communications System Design Mar. 1986 19 p (For primary document see N86-27566 18-32)
Avail: NTIS HC A09/MF A01

Before the advent of satellite platforms, sophisticated high frequency (HF) propagation and system research promised improved capability during disturbed ionospheric propagation conditions. However, satellite relays captured the imaginations and pocketbooks of the communications community in the mid-1960s. Consequently, extant HF systems aged while satellite systems were implemented. During peacetime, satellite systems transmit quality low data rate communications and navigation aids to mobile users, but there is now renewed interest in the low cost and survivability attributes of HF radio. At this time, when old HF prime systems need replacement for logistical reasons, the need for low cost communications that can survive jamming, nuclear effects, and space warfare is not satisfied. The HF renaissance is the response to this challenge. Logistical replacement procurements that provide new capabilities are redressing the attrition of vacuum-tube radio equipment over the last decade. Procuring organizations typically compile specifications comprising state-of-the-art and new capabilities offered by competing vendors. Integrated circuits, which include microprocessors, synthesizer ele ments, and other evolving components, have led to new circuit architectures. The first of the following three sections describes: Receivers; Transceivers and Antenna Couplers; Antenna Kits; and Audio Channel Peripherals. Author

N86-27574# Norwegian Defence Research Establishment, Kjeller.
PROPAGATION 2: PROBLEMS IN HF PROPAGATION
E. V. Thrane *In* AGARD Propagation Impact on Modern HF Communications System Design Mar. 1986 17 p Previously announced as N83-30870 (For primary document see N86-27566 18-32)
Avail: NTIS HC A09/MF A01

The ionosphere is not a perfect reflector for HF-waves, and the lecture will review some of the resulting propagation problems. Some of these are encountered during undisturbed ionospheric conditions, such as multipath reflections, but most problems are associated with geophysical disturbances. Solar flares and associated magnetic storms cause absorption, low MUF (Maximum Useable Frequency), scatter due to irregularities, etc., The ionosphere is particularly variable in high latitudes where auroral phenomena influence the reflecting properties of the ionospheric layers. The lecture discussed the presently available short term forecasting techniques, and it also deals with possible ways of

minimizing the effects of ionospheric disturbances, such as path and time diversity, the use of early warnings, and back-up systems. Author

N86-27575# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
MEASUREMENTS OF HF PROPAGATION PARAMETERS FOR REAL-TIME CHANNEL EVALUATION (RTCE) SYSTEMS
Mario D. Grossi *In* AGARD Propagation Impact on Modern HF Communications System Desing Mar. 1986 14 p (For primary document see N86-27566 18-32)
Avail: NTIS HC A09/MF A01

HF propagation paths are time-spread and frequency-spread channels, and are characterized by severe variability in the time domain of all their properties, inclusive of path losses. In addition, even when path conditions would be affordable,the link may be severely interfered with by other transmitters. Improvements over present-day link's performance in terms of circuit reliability, data rate and error rate can be achieved through the use of adaptive schemes capable of coping with the variability of the channel. Recent advances in microprocessor technology, in frequency-agile HF equipment and in the understanding of the propagation medium, make it feasible and practical to use adaptive schemes at HF. The simplest approach is to make the link adaptive to a selected channel parameter such as the Signal-to-Noise ratio. At the other extreme, the adaptive links can be designed to respond to all relevant channel functions, such as Signal-to-Noise ratio, multipath spread, Doppler spread, etc. In all cases, a necessary prerequisite for link's adaptivity is Real-Time Channel Evaluation (RTCE). The RTCE data gathering must match in scope and complexity the adaptivity scheme that is meant to serve. For instance, if the link's data rate is adjusted only to the Signal-to-Noise ratio, the RTCE must be kept very simple and must be reduced to the sole measurement of the signal intensity and to the level of the noise, inclusive of interference. Measurement of pertinent link's parameters by the RTCE must be performed at several spot frequencies in the band of interest, in order to identify automatically the most suitable carriers for the transmission of the information. RTCE is at present in the R&D phase, and the related activities consist almost solely of the measurement of signal amplitude and noise levels, inclusive of interference, at several frequencies in specific HF paths of interest, with only a few instances of inclusion of multipath spread measurements. At the successful completion of the R&D activity, it is expected that in a form or another, RTCE and the related adaptive schemes will enter the practice of modernized HF communications. Author

N86-27576# Petrie Telecommunications, Nepean (Ontario).
ADAPTIVE SYSTEMS IN OPERATION
L. E. Petrie *In* AGARD Propagation Impact on Modern HF Communications System Design Mar. 1986 10 p (For primary document see N86-27566 18-32)
Avail: NTIS HC A09/MF A01

The development and evolution of channel evaluation techniques is described. A recently developed fully automatic HF radio telephone system is discussed which automatically selects the suitable channel and also provides a telephone inter-connects. Also described is a HF message terminal which automatically requests, repeats and confirms message status for sender and receiver. Author

N86-27301*# Computer Sciences Corp., El Segundo, Calif.
THE NORTHERN UTAH SATELLITE (NUSAT) COMMUNICATIONS LINK
Lee Barrett *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 25-32 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27490# Joint Publications Research Service, Arlington, Va.
IMPROVEMENT OF LARGE SIGNAL INTERACTION MODEL FOR TWT
Wenmiao Song, Yongquan Liu, and Jingxian Wu *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 117-126 Transl. into ENGLISH from Dianzi Kexue Xuekan (Beijing, China), v. 7, no. 2, Mar. 1985 p 136-143 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27492# Joint Publications Research Service, Arlington, Va.
VERTICAL POLARIZED ANTENNA FOR SYNTHETIC APERTURE RADAR
Ruxian Wang and Guanhong Shen *In its* China Report: Science and Technology (JPRS-CST-98-008) 1 Mar. 1986 p 136-140 Transl. into ENGLISH from Dianzi Kexue Xuekan (Beijing, China), v. 7, no. 2, Mar. 1985 p 158-160 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27495# Joint Publications Research Service, Arlington, Va.
ADMITTANCE OF RECTANGULAR WAVEGUIDE OF SLOT ARRAY MEASURED
Zhixin Li *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 158-163 Transl. into ENGLISH from Dianzi Kexue Xuekan (Beijing, China), v. 7, no. 3, May 1983 p 227-231 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27503# Joint Publications Research Service, Arlington, Va.
COUPLING PROPERTIES OF SLOTTED ANTENNA STUDIED
Shanwei Lu, Jishi Ren, and Yin Fang *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 —p 54-70 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 13, no. 5, Sep. 1985 p 92-101 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

N86-27504# Joint Publications Research Service, Arlington, Va.
RADAR ANTENNA TRANSIENT EFFECTS STUDIED
Hannan Hu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 —p 71-81 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 11, no. 6, Nov. 1983 p 80-87 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

N86-27763*# Kyoto Univ. (Japan). Radio Atmospheric Science Center.
THE MU RADAR: CURRENT STATUS AND FIRST RESULTS
Susumu Kato, Shoichiro Fukao, Toshitaka Tsuda, and Toru Sato *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N86-27577*# National Aeronautics and Space Administration, Washington, D.C.
DESIGN REQUIREMENTS FOR RIGID PRINTED WIRING BOARDS AND ASSEMBLIES
Jan. 1986 98 p
(NHB-5300.4(3K); NAS 1.18:5300.4(3K)) Avail: NTIS HC A05/MF A01; also available SOD HC $5 as 033-000-

00982-8 CSCL 09A

The NASA requirements for assuring reliable rigid printed wiring board design are prescribed. Basic considerations necessary to assure reliable rigid printed wiring board design are described and incorporated. B.G.

N86-27578*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NEAR-FIELD TESTING OF THE 30 GHz TRW PROOF-OF-CONCEPT MULTIBEAM ANTENNA

Richard R. Kunath, Jr. and Robert J. Zakrajsek 1986 11 p Proposed for presentation at the Antenna Measurements Techniques Association 8th Annual Meeting and Symposium, Ottawa, Ontario, 23-25 Sep. 1986; sponsored by the National Research Council of Canada and the AMTA

(NASA-TM-87357; E-3115; NAS 1.15:87357) Avail: NTIS HC A02/MF A01 CSCL 09C

Near-field testing was conducted on the 30 GHz TRW proof-of-concept (POC) Multibeam Antenna (MBA). The TRW POC MBA is a dual offset Cassegrain reflector system using a 2.7 m main reflector. This configuration was selected to assess the ability to create both multiple fixed and scanned spot beams. The POC configuration investigated frequency reuse via spatial separation of beams, polarization selectivity and time division multiple access scanning at 30 GHz. Measurements of directivity, sidelobe level, and pattern were made at NASA Lewis Research Center's Near-Field Antenna Test Facility. Presented in this paper are complete results of these measurements. Included is a detailed discussion of all testing procedures and parameters. Results of additional testing used to evaluate diffraction effects of the subreflector and distortions of the main reflector are also presented. Author

N86-27579# ITT Advanced Technology Center, Shelton, Conn.

QUALITY PROCEDURES FOR VLSI/VHSIC (VERY LARGE SCALE INTEGRATED AND VERY HIGH SPEED INTEGRATED CIRCUITS) TYPE DEVICES Final Report, Sep. 1983 - Sep. 1985

Seymour Cohen Nov. 1985 135 p

(Contract F30602-83-C-0083)

(AD-A164885; RADC-TR-85-219) Avail: NTIS HC A07/MF A01 CSCL 09/5

Procedures for microcircuit screening and qualification to ensure the reliability and uniformity of VLSI/VHSIC devices were prepared. The use of Process Control Monitors (PCM) and Reliability Evaluation Modules (REM) were incorporated in the procedures. In addition, recommended guidelines for the evaluation of Computer-Aided-Manufacturing (CAM) facilities were generated in this study. A proposed replacement was provided for existing Method 5007 to MIL-STD-883, Wafer Acceptance Procedure which incorporates reliability screening, process quality evaluation, and electrical parameter testing of each wafer in a lot. GRA

N86-27580# Illinois Univ., Urbana. Coordinated Science Lab.

ASYMMETRICAL COUPLED COPLANAR-TYPE TRANSMISSION LINES WITH ANISOTROPIC SUBSTRATES

Toshihide Kitazawa, Yoshio Hayashi, and Raj Mittra Feb. 1986 33 p

(Contract N00014-84-C-0149)

(AD-A165007; UILU-ENG-86-2206) Avail: NTIS HC A03/MF A01 CSCL 09/5

Various types of transmission lines with anisotropic substrates have been investigated for use in microwave- and millimeter-wave integrated circuits. These include single and coupled striplines, slot lines, and coplanar-type transmission lines. The coplanar-type transmission lines (CTLs) are promising because of their easy adaptation to shunt element connections. The application of coupled coplanar-type transmission lines. (C-CTL) have been studied based on the quasistatic and hybrid-mode formulations and accurate numerical values are available for the cases with isotropic and/or anisotropic substrates. However, most of them assume the structural symmetry. The theoretical approach for the asymmetrical version is available only for the propagation constant of the case with a single isotropic substrate. This paper presents the analytical method for the general structure of asymmetrical coupled coplanar-type transmission lines with an anisotropic substrate. This method includes both the hybrid-mode and the quasistatic formulations and is useful for accurately computing the characteristics impedances as well as propagation constants of various types of asymmetrical coupled coplanar-type transmission lines. GRA

N86-27581# Polytechnic Inst. of New York, Farmingdale.

WORKSHOP ON NEW DIRECTIONS IN SOLID STATE POWER SWITCHES HELD AT FARMINGDALE, NEW YORK ON 28-30 AUGUST 1985 Final Report, 1 Jul. - 31 Dec. 1985

Benjamin Senitzky 24 Dec. 1985 481 p Workshop held at Farmingdale, N.Y., 28-30 Aug. 1985

(Contract N00014-85-G-0236)

(AD-A165039) Avail: NTIS HC A21/MF A01 CSCL 09/5

The Workshop on New Directions in Solid State Power Switching was conducted on August 28 to 30, 1985, by the Weber Research Institute of the Polytechnic Institute of New York. The workshop invited people from different areas to discuss the relevant properties of solid state power switches. Four groups were formed to identify research directions in the following areas: (1) Potential Materials for Solid State Switches, (2) Relaxation Mechanisms, (3) Volume and Surface Breakdown, and (4) Solid State Plasma Transport. GRA

N86-27582# Army Electronic Proving Ground, Fort Huachuca, Ariz.

AUTOMATED AIDS TO TEST DATA GENERATION Final Methodology Investigation Report

William H. Kukes Nov. 1985 47 p

(AD-A165047) Avail: NTIS HC A03/MF A01 CSCL 09/3

The Automated Aids to Test Data Generation investigation was initiated to provide a method for automating the composition and validation of scenarios used in the developmental testing of message-driven systems. Existing scenario development software and procedures were examined to identify processes amenable to automation. From those identified, specific processes were selected for further study. Functional requirements were then developed and an Automated Message Generation (AMG) tool was designed. Subsequent project effort focused on the implementation of this tool. The application of the AMG tool to Test Item Stimulator (TIS) scenario development processes would serve to validate the AMG design. In addition, the application of this tool to the development of tactically significant scenarios would result in the refinement of the AMG design and the identification of additional processes amenable to automation. GRA

N86-27583# Harry Diamond Labs., Adelphi, Md.

DEVELOPMENT AND OPERATING CHARACTERISTICS OF THE PS132 THERMAL BATTERY

Frank C. Krieger Jan. 1986 48 p

(AD-A165149; HDL-TR-2075) Avail: NTIS HC A03/MF A01 CSCL 11/6

The development and operating characterisitics of the PS132 thermal battery are described. The PS132 uses the electrochemical system Ca/LiCl-KCl eutectic-SiO2CACRO4, and it is one of the smallest batteries of its type ever built that can meet its electrical and envronmental requirements. A development program that included construction of approximately 400 PS132-like batteries showed that obtaining acceptable DEB electrolyte-cathode powders was a major problem. Most commercial DEB powders caused excessive amounts of CaLi2 molten metal to form in the operating thermal cells of the PS132. This molten metal then flowed from the cells and caused electrical short circuits. GRA

N86-27584# Department of the Army, Washington, D. C.

METHOD OF MONITORING ELECTROCHEMICAL CELLS Patent Application

Gregory J. Malinowski and Deborah M. Chaskin, inventors (to Army) Filed 13 Mar. 1986 11 p

(AD-D012175; US-Patent-Appl-SN-831027) Avail: NTIS HC A02/MF A01 CSCL 01/3

The physical and electrical condition of electrochemical cells of a battery is monitored on a continuous basis so that corrective action can be taken before explosion and/or venting occurs by a method including the steps of: (A) coating the electrically conductive shell of each cell of the battery with a thin nonelectrically conductive layer; (B) applying a sensor stripe over the nonelectrically conductive layer so that the sensor stripe does not make electrical contact to the shell of the cell; (C) connecting leads to the sensor and then coating the sensor with a protective layer; and (D) connecting the sensor leads of individual cells of the battery into an electrical series circuit, the remaining leads of the series sensor circuit being connected to an alarm/control network that monitors the conductivity of the series electrical path. GRA

N86-27585# Argonne National Lab., Ill.
FIRST INTERNATIONAL WORKSHOP ON BATTERY TESTING. WORKBOOK AND EXTENDED ABSTRACTS: SUMMARIES
E. Estand, (comp.) Sep. 1985 197 p Presented at the International Battery Testing Workshop, Heidelberg, West Germany, 29 Sep. 1985
(Contract W-31-109-eng-38)
(DE86-001615; CONF-8509154-Summs) Avail: NTIS HC A09/MF A01

Thirty-nine papers are presented under the following session headings: international overview; general testing procedures; testing of special battery systems; accelerated life cycle tests; instrumentation, hardware, equipment; post-test analyses, thermal management; and field testing and correlating laboratory tests with on-board EV tests. DOE

N86-27586# Argonne National Lab., Ill.
LITHIUM-ALLOY/IRON SULFIDE BATTERIES
P. A. Nelson and H. Shimotake (Amoco Oil Co., Naperville, Ill.) 1986 7 p Presented at the International Symposium on Fuel Cell and Advanced Battery, Tokyo, Japan, 22 Jan. 1986 Prepared in cooperation with Amoco Research Center, Naperville, Ill.
(Contract W-31-109-eng-38)
(DE86-005529; CONF-860138-2) Avail: NTIS HC A02/MF A01

Lithium-alloy/FeS cells with a theoretical capacity of 200 to 400 Ah have been developed. These cells have achieved high specific energy (100 Wh/kg), high power (150 Wh/kg), and long life (1000 cycles). Electrode experiments and design studies indicate the possibility of improving specific energy and power by 50 to 100% and, perhaps, retaining cycle life. DOE

N86-27587# Brookhaven National Lab., Upton, N. Y.
CABLE INSULATION DEVELOPMENT. PART 2: SUPERCONDUCTING POWER TRANSMISSION SYSTEM DEVELOPMENT
Semiannual Report, 1 Oct. 1984 - 31 Mar. 1985
19 Jul. 1985 58 p
(Contract DE-AC02-76CH-00016)
(DE86-005653; BNL-51920) Avail: NTIS HC A04/MF A01

Objectives are to develop a superconducting power transmission system and cable insulation using polymeric tapes. This report is divided into: ambient temperature high stress power cable development; and 1000-MVA test facility. DOE

N86-27588# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
EFFICIENT AND ACCURATE METHOD FOR CALCULATING AND REPRESENTING POWER DENSITY IN THE NEAR-ZONE OF MICROWAVE ANTENNAS
R. L. Lewis and A. C. Newell Dec. 1985 44 p
(PB86-181963; NBSIR-85/3036) Avail: NTIS HC A03/MF A01 CSCL 09E

An algorithm is presented for calculating near-zone and Fresnel-region fields in front of microwave antennas from discrete numerical values of the radiated plane-wave spectrum (complex far-field pattern). That is, the near fields are calculated by numerically integrating the plane-wave spectrum representation of the field. The crux of the analysis consists of handing a numerical instability which arises from integrating discrete data. A criterion is developed for limiting the integration domain in order to exclude highly oscillatory regions of the integrand. In turn, this leads to restricting the applicable output range over which the field can be computed. With the numerical instability problem thus resolved, fast Fourier transform techniques are used to assure efficient numerical integration over a large (but restricted) output range. GRA

N86-27589# Saad Publications, Karachi (Pakistan). Translation Div.
THE 2ND NATIONAL SYMPOSIUM IN RADIO SCIENCE, GDANSK
Mar. 1986 287 p Transl. ito ENGLISH from Polska Akademie Nauk for Union Radio-Scientifique Internationale (Gdansk, Poland), 1978 287 p Sponsored by NSF Prepared in cooperation with Smithsonian Inst. Libraries, Washington, D.C.
(PB86-174224; TT-81-53726) Avail: NTIS HC A15/MF A01 CSCL 09C

The subject matter of the symposium is divided into four sections: electronic elments, circuits and systems; signals and systems; field theory, electromagnetic waves; and electromagnetic metrology and radioastronomy. Author

N86-27371# Technische Univ., Brunswick (West Germany). Inst. fuer Elekt. Maschinen, Antriebe, und Bahnen.
DIRECTLY-DRIVEN SERVOMOTOR WITH VERY HIGH TORQUE
H. Weh, P.-Chr. Leymann, and W. Niemann *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 121-126 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27373# Societe Europeenne de Propulsion, Vernon (France).
ELECTRIC MOTOR WITH SUPERCONDUCTING WINDINGS FOR ACTUATION MECHANISM IN THE FOCAL PLANE OF A SPACE CRYOSTAT
J. P. Bugeat, R. Petit, D. Valentian, M. Junca, and M. Verain *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 133-138 (For primary document see N86-27353 18-18)
(Contract ESA-5609/83)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27380# Spar Aerospace Ltd., Ste-Anne-de-Bellevue (Quebec).
DESIGN AND TEST OF A LINEAR THERMAL ACTUATOR
G. Bush, D. Osborne, and V. A. Wehrle *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 181-185 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27383# Indian Space Research Organization, Trivandrum. Vikram Sarabhai Space Center.
DESIGN AND DEVELOPMENT OF A BRUSHLESS dc MOTOR FOR SPACE APPLICATIONS
N. Kannan, A. Bose, and N. Vedachalam *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 201-206 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27384# Moore Reed and Co. Ltd., Walworth (England).
A SPACE-COMPATIBLE ANGULAR CONTACT ENCODER
A. R. Flew *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 207-212 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27489# Joint Publications Research Service, Arlington, Va.
CHARACTERISTIC OF VANE-LOADED HELIX SLOW-WAVE STRUCTURE
Qingyou Chen *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 105-116 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 11, no. 5, Sep. 1983 p 23-32 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27491# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL EXPERT SYSTEM, BLOCK, FOR USE IN CIRCUIT DESIGN
Yongsui Fang, Jiren Lu, Zongxuan Hu, and Zhaoming Wang *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 127-135 Transl. into ENGLISH from Dianzi Kexue Xuekan (Beijing, China), v. 7, no. 2, Mar. 1985 p 92-97 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27494# Joint Publications Research Service, Arlington, Va.
NEW DT(SUP)2L SYSTEM OF LARGE-SCALE INTEGRATED CIRCUIT DESCRIBED
Yanhong Li *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 148-157 Transl. into ENGLISH from Dianzi Kexue Jishu (Beijing, China), no. 12, 10 Dec. 1984 p 8-11, 18 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27497# Joint Publications Research Service, Arlington, Va.
DESIGN SCHEME OF 8mm HIGH-POWER COAXIAL MAGNETRON DESCRIBED
Mingye Chen *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 169-173 Transl. into ENGLISH from Dianzi Kexue Xuekan (Beijing, China), v. 6, no. 3, May 1984 p 259-281 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27505# Joint Publications Research Service, Arlington, Va.
LARGE SIGNAL THEORY, COMPUTATION OF COUPLED-CAVITY TWT'S
Wenmiao Song and Zhenhuai Li *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 —p 82-93 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 12, no. 3, May 1984 p 25-32 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N86-27590 ESDU International Ltd., London (England).
BOILING INSIDE TUBES: GENERAL ASPECTS AND ESTIMATED WET-WALL HEAT TRANSFER
Dec. 1985 42 p
(ESDU-85041; ISBN-0-85679-547-X; ISSN-0141-402X) Avail: ESDU

Data item ESDU 85041, a part of the Heat Transfer Sub-series, discusses the problems met in thermal rating a vaporizer in terms of the flow patterns in boiling flow, the conditions for nucleate boiling, considerations of burnout and dryout, the use of mixtures, and the flow instabilities that can occur. Nine correlations for wet-wall boiling of a pure liquid are evaluated against over 3000 experimental points taken from the literature and the results tabulated. The most reliable prediction method was chosen and a graph shows its performance against experimental data for water, ethylene glycol, and a number of refrigerants. A calculation procedure based on that correlation is provided, including checks on whether nucleate boiling or statified flow exists. The calculation of the surface area required to reach a selected flow quality is also given. A practical worked example illustrates the use of the method. It applies to steam generators and to vaporizers for process fluids. Large water tube boilers used in power generation are outside the scope, however. ESDU

N86-27591 ESDU International Ltd., London (England).
EFFECTIVENESS-N SUB TU RELATIONSHIPS FOR THE DESIGN AND PERFORMANCE EVALUATION OF TWO-STREAM HEAT EXCHANGERS
Dec. 1985 57 p
(ESDU-85042; ISBN-0-85679-548-8; ISSN-0141-402X) Avail: ESDU

Data item ESDU 85042, Heat Transfer Sub-Series, gives equations and a large number of curves derived from them to allow design or performance evaluation of shell-and-tube heat exchangers. The curves cover co-current and countercurrent flow and various numbers of shells and of tube side passes. Also shown on the curves are the locus of designs for which a temperature cross may occur and the locus or 95 percent heat transfer effectiveness which indicates the region of uneconomic design. The method assumes a linear temperature/enthalpy relationship (constant specific heat capacity) for both streams. It applies to boiling or condensing flow of a single component with no temperature change, or boiling and condensing flow of a mixture that is always two phase. It excludes conditions in which transition from single to two-phase flow occurs. Worked examples show the application of the method. ESDU

N86-27592 Engineering Sciences Data Unit, London (England).
FLUID TRANSIENTS IN PIPES. PRESSURE SURGE FOLLOWING BOOSTER PUMP TRIP. SUPPRESSION USING PUMP BYPASS
1985 67 p
(ESDU-85044; ISBN-0-85679-550-X; ISSN-0141-4011) Avail: ESDU

Data item ESDU 85044, Fluid Mechanics Sub-Series, gives a graphical method of estimating the magnitudes of the surge pressures following power failures to a booster pump that is protected by a one-way valve preventing reverse flow through the pump. The system may also be protected by a bypass which itself includes a one-way valve that closes when flow through the bypass falls to zero. The graphical methods allow the head and flow conditions to be found at the suction and discharge sides of the pump with or without the bypass circuit. The effect of pipe friction may be taken into account. A computer program in BASIC is included that also allow the pump run-down characteristics to be modeled and provides results for the pressure changes over the whole line. The use of the information is illustrated in a practical worked example. ESDU

N86-27593* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MULTI-LEG HEAT PIPE EVAPORATOR Patent
Joseph P. Alario (Grumman Aerospace Corp., Bethpage, N.Y.) and Robert A. Haslett, inventors (to NASA) Issued 22 Apr. 1986 7 p Filed 31 May 1984 Supersedes N84-32748 (22 - 22, p 3592) Sponsored by NASA. Johnson Space Center
(NASA-Case-MSC-20812-1; US-Patent-4,583,587; US-Patent-Appl-SN-616002; US-Patent-Class-165-104.26; US-Patent-Class-122-366; US-Patnet-Class-165-41; US-Patent-Class-165-104.14) Avail: US Patent and Trademark Office CSCL 20D

A multileg heat pipe evaporator facilitates the use and application of a monogroove heat pipe by providing an evaporation section which is compact in area and structurally more compatible with certain heat exchangers or heat input apparatus. The evaporation section of a monogroove heat pipe is formed by a series of parallel legs having a liquid and a vapor channel and a communicating capillary slot therebetween. The liquid and vapor channels and interconnecting capillary slots of the evapora-

ting section are connected to the condensing section of the heat pipe by a manifold connecting liquid and vapor channels of the parallel evaporation section legs with the corresponding liquid and vapor channels of the condensing section. NASA

N86-27594# National Aerospace Lab., Tokyo (Japan).
NUMERICAL SIMULATION OF THE RETURN TO ISOTROPY OF HOMOGENEOUS TURBULENCE
Kiyoshi Yamamoto Oct. 1985 15 p In JAPANESE; ENGLISH summary
(NAL-TR-885; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

Direct numerical simulation of the return to isotropy of homogeneous turbulence is carried out for the various initial anisotropic turbulent fields. Navier-Stokes equation is calculated with the spectral method using 32 to the 3rd Fourier components of velocity. The numerical results show that the two rotational invariants 2 and 3 of the anisotropy tensor which describes the departure of the Reynolds stress from isotrophy characterize well the process of the return to isotrophy of homogeneous turbulence. The values of the constant in the Rotta's turbulence model are calculated for the tensor components of the pressure-strain correlation and the mean Rotta's constant is evaluated from the least squares mean of these tensor components for each anisotropic turbulence. The mean Rotta's constants of the various anisotropic turbulence show a nearly identical variation in time in the range from 0.5 to 4.0, which roughly coincides with the dispersive range of the experimental results. The variation of the Rotta's constant implies its dependence on variants 2, 3, and Reynolds number. Author

N86-27595# National Aerospace Lab., Tokyo (Japan).
PNEUMATIC ATOMISATION WITH COAXIAL INJECTORS: MEASUREMENTS OF DROP SIZES BY THE DIFFRACTION METHOD AND LIQUID PHASE FRACTION BY THE ATTENUATION METHOD OF LIGHT
Hiromi Gomi Nov. 1985 55 p
(NAL-TR-888T; ISSN-0389-4010) Avail: NTIS HC A04/MF A01

Sprays, formed by coaxial injectors with water/air and water/helium to model liquid oxygen/hydrogen atomization in a rocket engine, were measured by a particle size meter. A criterion that the transmittance of light be more than 50% for a reliable measurement restricted water injection flow rates to less than 10 g/s. Bimodal distribution of diffracted light energy also impeded measurements at high injection mass ratios of liquid to gas. The drop sizes increased with the distance from the injectors and spray axis. The drop sizes on the spray axis had their local maximum with a high injection gas celocity and their minimum with a low injection gas velocity. The minimum drop of D sub p,min = 5.8 microns used in the drop size distribution gave ratios of the Sauter mean diameter to the mass median diameter consistant with other studies. Regimes of atomization are proposed. Author

N86-27596# National Aerospace Lab., Tokyo (Japan).
TURBULENCE PROPERTIES OF JET AND PLUME
Hiroshi Ishigaki and Munekazu Mochizuki Dec. 1985 11 p In JAPANESE; ENGLISH summary
(NAL-TR-894; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

The plane and round turbulent buoyant jets issuing vertically into quiescent fluid are analyzed. As the flow travels farther from the exit, it changes from a jet into a plume. Formulae on turbulent shear stress and heat flux are derived for jet and plume, and compared with the available experimental data. In addition, profiles of turbulent eddy viscosity and turbulent prandtl number are given. Author

N86-27597# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS
1985 534 p Lecture held in Rhode-Saint-Genese, Belgium, 21-25 Jan. 1985 Sponsored in part by AGARD
(VKI-LS-1985-01; ESA-85-95396) Avail: NTIS HC A23/MF A01

The Von Karman Institute for Fluid Mechanics sponsored a lecture series entitled 'Introduction to Computational Fluid Dynamics,' which took place in Rhode Saint Genese, Belgium, on 21-25 January, 1985. Among the topics discussed were the following: a solution technique for compressible boundary layers; turbulent boundary layer turbulence models; implicit time dependent methods for inviscid andviscous compressible flows; finite difference approximations of the Navier-Stokes equations for incompressible flows; and numerical analysis of vortex breakdown. For individual titles, see N86-27598 through N86-27603.

N86-27598# Maryland Univ., College Park. Dept. of Aerospace Engineering.
INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS
John D. Anderson *In* Von Karman Inst. for Fluid Dynamics Introduction to Computational Fluid Dynamics 1985 269 p (For primary document see N86-27597 18-34)
Avail: NTIS HC A23/MF A01

The basic philosophy of computational fluid dynamics; the governing equations of fluid dynamics; mathematical properties of fluid dynamic equations; discretization of partial differential equations; transformations and grids; source and panel vortex methods for incompressible inviscid flows; and applications of explicit finite difference methods to inviscid and viscous flows are introduced. Author (ESA)

N86-27599# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
COMPRESSIBLE BOUNDARY LAYERS: AN EXAMPLE OF AN EFFICIENT SOLUTION TECHNIQUE
R. Arina, C. Benocci, and J.-A. Essers *In its* Introduction to Computational Fluid Dynamics 1985 61 p (For primary document see N86-27597 18-34)
Avail: NTIS HC A23/MF A01

The solution of two dimensional and axisymmetric boundary layers by finite difference schemes is introduced. A method based on a combination of the generalized Crank-Nicholson and box schemes is presented and applied to boundary layer flows. The technique can be extended to the computation of wakes and jets. Laminar flows are treated, but the conclusions can be applied to the turbulent case, providing the equations are written formally in laminar form. The boundary layer equations are presented in tensorial notation to take into account curvature effects. The general equations are specialized for steady two dimensional and axisymmetric flows. A method for the solution of compressible two dimensional and axisymmetric boundary layer flows on a wall with modest curvature is outlined. Information concerning three dimensional boundary layers is presented. Author (ESA)

N86-27600# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBULENT BOUNDARY LAYERS: EXAMPLES OF TURBULENCE MODELS
R. Arina and C. Benocci *In its* Introduction to Computational Fluid Dynamics 1985 45 p (For primary document see N86-27597 18-34)
Avail: NTIS HC A23/MF A01

Turbulence models for boundary layer flows and the principles to be followed for their implementation in the frame of an existing boundary layer solver are presented. The selection of the appropriate model and the optimization of the numerical solution are illustrated with examples for compressible and incompressible regimes. Author (ESA)

N86-27601# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
IMPLICIT TIME DEPENDENT METHODS FOR INVISCID AND VISCOUS COMPRESSIBLE FLOWS
G. Degrez *In its* Introduction to Computational Fluid Dynamics 1985 61 p (For primary document see N86-27597 18-34)
Avail: NTIS HC A23/MF A01

Linear multistep methods; predictor-corrector methods; centered implicit dissipation schemes; and characteristic modeling schemes for compressible flows are introduced. The multistep

algorithm is unconditionally stable and the error on the converged steady solution does not depend on the time step used, but the short wavelengths are not damped and therefore the scheme is not dissipative in the sense of Kreiss. Dissipation is provided by appending explicit and implicit artificial viscosity. The predictor-corrector scheme is centered in space for a linear equation intrinsically dissipative without artificial viscosity and requires the solution of two block bidiagonal systems for each space variable. The implicit schemes are single step schemes with centered differencing in space. The time differencing produces the appropriate dissipation. For Euler equations, characteristic schemes produce the dissipation by noncentered discretization in space.
Author (ESA)

N86-27602# Technische Hochschule, Aachen (West Germany). Inst. fuer Aerodynamik.
FINITE-DIFFERENCE APPROXIMATIONS OF THE NAVIER-STOKES EQUATIONS FOR INCOMPRESSIBLE FLOWS
Egon Krause *In* Von Karman Inst. for Fluid Dynamics Introduction to Computational Fluid Dynamics 1985 47 p (For primary document see N86-27597 18-34)
Avail: NTIS HC A23/MF A01

Numerical solutions of the Navier-Stokes equations for incompressible unsteady two and three dimensional viscous flows are introduced. The differential formulations of the continuity equation and of the momentum equations are derived from the integral relations for mass conservation and momentum balance. The energy fluxes and the energy equation are described. The vorticity transport equation with the Poisson equation for the stream function and the pressure; the Poisson equations for the velocity components for two dimensional flow related to the gradients of the vorticity component; the fourth order equation for the stream function of two dimensional flow; and the divergence form of the equations of motion are obtained. Author (ESA)

N86-27603# Technische Hochschule, Aachen (West Germany). Inst. fuer Aerodynamik.
NUMERICAL ANALYSIS OF VORTEX BREAKDOWN
Egon Krause *In* Von Karman Inst. for Fluid Dynamics Introduction to Computational Fluid Dynamics 1985 23 p (For primary document see N86-27597 18-34)
Avail: NTIS HC A23/MF A01

Spiral, bubble, and double helix type vortex breakdowns are discussed. Hall's conjecture (that when an adverse pressure gradient is increased, less swirl is required to maintain breakdown, or if the same level of swirl is maintained, the breakdown is moved upstream) is proved. Estimation of the axial pressure gradient; computation of breakdown point for slender vortices; initial and boundary conditions; and determination of the pressure are considered. Author(ESA)

N86-27604# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
QUICK REPRODUCTION OF BLAST-WAVE FLOW-FIELD PROPERTIES OF NUCLEAR, TNT, AND ANFO EXPLOSIONS
Clinton P. T. Groth Apr. 1986 93 p Sponsored in cooperation with Science, Systems and Software and Defense Research Establishment
(UTIAS-TN-259; ISSN-0082-5263) Avail: NTIS HC A05/MF A01

In many instances, extensive blast-wave flow-field properties are required in gasdynamics research studies of blast-wave loading and structure response, and in evaluating the effects of explosions on their environment. This report provides a very useful computer code, which can be used in conjunction with the DNA Nuclear Blast Standard subroutines and code, to quickly reconstruct complete and fairly accurate blast-wave data for almost any free-air (spherical) and surface-burst (hemispherical) nuclear, trinitrotoluene (TNT), or ammonium nitrate-fuel oil (ANFO) explosion. This code is capable of computing all of the main flow properties as functions of radius and time, as well as providing additional information regarding air viscosity, reflected shock-wave properties, and the initial decay of the flow properties just behind the shock front. Both spatial and temporal distributions of the major blast-wave flow properties are also made readily available. Finally, provisions are also included in the code to provide additional information regarding the peak or shock-front flow properties over a range of radii, for a specific explosion of interest. Author

N86-27605# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
LASER DOPPLER VELOCIMETRY MEASUREMENTS IN COAXIAL, CO- AND COUNTER-SWIRLING, ISOTHERMAL JETS
P. A. Robinson, R. A. Cusworth, and J. P. Sislian May 1986 81 p Sponsored by the Natural Sciences and Engineering Research Council of Canada
(UTIAS-308; ISSN-0082-5255) Avail: NTIS HC A05/MF A01

Measured values of the three components of mean velocity and the six components of the turbulent stress tensor are reported in free, co-axial, isothermal, co- and counter-swirling jet flows representative of combustor flows. The effects of specific radial distributions of mean swirl velocity, and co- and counter-swirling annular flows on the flow field are investigated. A one-dimensional laser Doppler velocimeter is used to obtain the measurements. It consists of a 15mW He-Ne laser, DISA 55x modular optics with a Bragg cell and electronic frequency shifting to handle high turbulence intensities and reverse flow regions, and a TSI model 1980A counter processor. Measured values are presented for two tangential velocity profiles in co- and counter-swirling annular flows, in all, for four different cases. A central recirculation zone occurs in each case. Streamlines are calculated from the measured velocity distribution, and contours of turbulent kinetic energy are presented. The former show the structure of the CRZ, and the latter indicate the zones of high turbulence intensity. Experimental data indicate that the flows are more affected by the direction of rotation of the annular flow than by altering the radial distribution of mean swirl velocity. Counter-swirl tends to increase the turbulent stresses with the maxima occuring near the boundary of the CRZ. Author

N86-27606# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
SIMULATION OF A BLAST WAVE3 IN A SHOCK TUBE BY USING PERFORATED PLATES IN THE DRIVER
K. Y. Zhang and J. J. Gottlieb Mar. 1986 234 p Sponsored in cooperation with Defence Research Establishment, BRL, and the Natural Sciences and Engineering Research Council of Canada
(UTIAS-304; ISSN-0082-5255) Avail: NTIS HC A11/MF A01

The simulation of a blast wave in a conventional air-driven shock tube by means of judiciously positioning perforated plates in the driver with porosities judiciously selected is investigated both numerically and experimentally. For the numerical study the random-choice method is used in a much improved and extended form. Most notable in terms of the anaysis, which is presented and explained in detail, is the incorporation of perforated plates with area changes and head losses, head losses from poor diaphragm breakage, friction and heat transfer at the walls, mass loss by jets out of perforations in the walls, sudden changes in grid node spacing, and duct ends that are open to the atmosphere and may or may not include a reflection eliminator. The analysis is also developed to make the computer code efficient, and a factor of at least two is gained in computational time over earlier UTIAS programs. The validity of the analysis and computer code is demonstrated by presenting a number of comparisons of numerical and experimental data. Finally, in terms of numerical predictions, they are made for three different blast-wave simulators. The first has a constant area driver and channel 2.44 m in diameter and an 83-m-long driver with six perforated plates. The last two have a channel 1.22 m in diameter and a constant-area driver 15.2 m long and 2.13 m in diameter, but one driver has six perforated plates and the other only three. For all three simulators the extensive sets of numerical predictions include blast-wave peak overpressures of 1/6, 1/3, 2/3, 1, 3/2, 2, 5/2, and 3 atm, and predictions are also given for the important companion cases of driver-air heating which eliminates density and temperature discontinuities across the contact surface. Author

N86-27607*# Pennsylvania State Univ., State College. Applied Research Lab.
THE BOUNDARY LAYER ON COMPRESSOR CASCADE BLADES Semiannual Progress Report, 1 Dec. 1985 - 1 Jun. 1986
STeven Deutsch and William C. Zierke 1986 20 p
(Grant NsG-3264)
(NASA-CR-177279; NAS 1.26:177279) Avail: NTIS HC A02/MF A01 CSCL 20D

The purpose of NASA Research Grant NSG-3264 is to characterize the flowfield about an airfoil in a cascade at chord Reynolds number(R sub C)near 5 x 10 to the 5th power. The program is experimental and combines laser Doppler velocimeter (LDV) measurements with flow visualization techniques in order to obtain detailed flow data, e.g., boundary layer profiles, points of separation and the transition zone, on a cascade of highly-loaded compressor blades. The information provided by this study is to serve as benchmark data for the evaluation of current and future compressor cascade predictive models, in this way aiding in the compressor design process. Summarized is the research activity for the period 1 December 1985 through 1 June 1986. Progress made from 1 June 1979 through 1 December 1985 is presented. Detailed measurements have been completed at the initial cascade angle of 53 deg. (incidence angle 5 degrees). A three part study, based on that data, has been accepted as part of the 1986 Gas Turbine Conference and will be submitted for subsequent journal publication. Also presented are data for a second cascade angle of 45 deg (an incidence angle of 3 degrees). Author

N86-27608# National Bureau of Standards, Gaithersburg, Md. Center for Fire Research.
BUOYANCY DRIVEN FLOW AS THE FORCING FUNCTION OF SMOKE TRANSPORT MODELS Final Report
Walter W. Jones and Xavier Bodart May 1986 26 p
(NBSIR-86-3329) Avail: NTIS HC A03/MF A01

Flow at vents is the major driving force in smoke transport models. The precision with which we can calculate these flows determines to a great extent how accurately we can model buoyant flow and the inherent speed of the models. This report describes some of the problems encountered in calculating these flows, and gives a general algorithm for their calculation. Author

N86-27609# Cornell Univ., Ithaca, N.Y. School of Mechanical and Aerospace Engineering.
FRONTIERS IN FLUID MECHANICS: A COLLECTION OF RESEARCH PAPERS WRITTEN IN COMMEMORATION OF THE 65TH BIRTHDAY OF STANLEY CORRSIN Final Report, 1 Aug. 1984 - 30 Apr. 1985
Stephen H. Davis, ed. (Northwestern Univ., Evanston, Ill.) and John L. Lumley, ed. Berlin, West Germany Springer-Verlag 30 Apr. 1985 298 p
(Contract N00014-84-G-0127)
(AD-A165139; ISBN-3-540-15361-6; ISBN-0-387-15361) Avail: NTIS HC A13/MF A01 CSCL 20/4

A collection of research papers on fluid dynamics dedicated to the 65th birthday of Stanley Corrsin includes the following topics: On the Approach to Isotropy of Homogeneous Turbulence: Effect of the Partition of Kinetic Energy Among the Velocity Components; Random Incompressible Motion on Two and Three-Dimensional Lattices and its Application to the Walk on a Random Field: Transition and Turbulence in Fluid Flows and Low-Dimensional Chaos; Some Contributions of Two-Point Closure to Turbulence; Intermittent Turbulent Flow; The Spectra of Single Reactants in Homogeneous Turbulence; The Dynamics of Turbulent Spots; Spectral and Statistical Characteristics of Breaking Waves; How Do Drops Spread on Solids?; Effects of Steamline Curvature on Turbulence; Limitations of Second Order Modeling of Passive Scalar Diffusion; and Acoustic Wave Propagation in Fluids. GRA

N86-27610# Naval Research Lab., Washington, D. C.
DIRECT NUMERICAL SIMULATION OF AXISYMMETRIC JETS
F. F. Grinstein, Elaine S. Oran, and J. P. Boris 25 Mar. 1986 16 p
(AD-A165536; NRL-MR-5732) Avail: NTIS HC A02/MF A01 CSCL 20/4

Results are presented from numerical calculations of the evolution of the Kelvin-Helmholtz instability for an unforced, subsonic, compressible axisymmetric, spatially-evolving shear layer. In addition, the effect of small, random pressure fluctuations at the nozzle orifice on the growth of the mixing layers is studied. These fluctuations model inflow perturbations in experimental flows arising from turbulence and boundary layers in the nozzle. The finite-difference numerical model used to perform the simulations solves the two-dimensional time-dependent conservation equations for an ideal fluid using the Flux-Corrected Transport algorithm and timestep-splitting techniques. No subgrid turbulence model has been included. In the absence of perturbations, the calculations indicate that the large scale development of the unforced jet shear layer has an underlying degree of organization. This is the result of a feedback mechanism in which the shear layer ahead of nozzle edge is modulated by the far field induced by the mergings on downstream, near the end of the potential core of the jet. The studies with random high frequency perturbations on the inflow velocity show that they effectively tend to break the temporal correlations between the structures. GRA

N86-27611# Los Alamos National Lab., N. Mex.
MEASUREMENT AND MODELING OF INTERFACE HEAT TRANSFER COEFFICIENTS
A. D. Rollett, H. D. Lewis, and P. S. Dunn 1985 12 p Presented at the Modeling and Control of Casting and Welding Processes Conference, Santa Barbara, Calif., 12 Jan. 1986
(Contract W-7405-eng-36)
(DE86-004744; LA-UR-85-4367; CONF-860132-1) Avail: NTIS HC A02/MF A01

The results of preliminary work on the modeling and measurement of the heat transfer coefficients of metal/mold interfaces is reported. The system investigated is the casting of uranium in graphite molds. The motivation for the work is primarily to improve the accuracy of process modeling of prototype mold designs at the Los Alamos Foundry. The evolution in design of a suitable mold for unidirectional solidification is described, illustrating the value of simulating mold designs prior to use. Experimentation indicated a heat transfer coefficient of 2 kW/sq m /K both with and without superheat. It was possible to distinguish between solidification due to the mold and that due to radiative heat loss. This permitted an experimental estimate of the emissivity, epsilon = 0.2, of the solidified metal. DOE

N86-27218# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CRITICAL EXAMINATION OF TURBULENCE MODELS FOR A SEPARATED THREE DIMENSIONAL TURBULENT BOUNDARY LAYER
R. Abid and R. Schmitt *In its* La Recherche Aerospatiale. Bimonthly Bulletin, no. 1984-6, November - December 1984 (ESA-TT-907) May 1985 11 p (For primary document see N86-27217 18-02)
Avail: NTIS HC A04/MF A01; HC also available in English and French from ONERA, Paris FF 70

N86-27219# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A VORTEX POINT METHOD FOR CALCULATING INVISCID INCOMPRESSIBLE FLOWS AROUND ROTARY WINGS
B. Canatloube and S. Huberson *In its* La Recherche Aerospatiale. Bimonthly Bulletin, no. 1984-6, November - December 1984 (ESA-TT-907) May 1985 13 p Previously announced in IAA as A86-12021 (For primary document see N86-27217 18-02)
Avail: NTIS HC A04/MF A01; HC also available in English and French from ONERA, Paris FF 70

N86-27302*# Worcester Polytechnic Inst., Mass.
FLUID BEHAVIOR IN MICROGRAVITY
William W. Durgin and James W. Matthews *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 33-40 refs (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27308*# Asahi National Broadcasting Co., Tokyo (Japan).
WATER BALL COLLISION
Kazuo Fujimoto *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 81-84 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27318*# Messerschmitt-Boelkow-Blohm/Entwicklungspring Nord, Bremen (West Germany).
GAS PAYLOAD NO. G-025: STUDY OF LIQUID SLOSHING BEHAVIOUR IN MICROGRAVITY
C. R. Gilbert *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 165-176 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27324*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CAPILLARY PUMPED LOOP (CPL) GAS EXPERIMENT G-471
Dan Butler *In its* The 1985 Get Away Special Experimenter's Symposium May 1986 p 237-253 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27329*# Utah State Univ., Logan. Center for Atmospheric and Space Science.
THERMOCAPILLARY FLOW AND GASEOUS CONVECTION IN MICROGRAVITY: RESULTS FROM GAS PAYLOAD G-0518
Scott Thomas *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 293-301 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27635# Ecolè Royale Militaire, Brussels (Belgium).
MEASUREMENTS IN TWO-PHASE FLOWS
R. Decuypere *In* Von Karman Inst. for Fluid Dynamics Measurements Techniques in Turbomachines, Volume 2 1985 92 p (For primary document see N86-27631 18-37)
Avail: NTIS HC A17/MF A01

N86-27636# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SHORT DURATION HEAT TRANSFER MEASUREMENTS
Tony Arts and Cengiz Camci *In its* Measurements Techniques in Turbomachines, Volume 2 1985 50 p (For primary document see N86-27631 18-37)
Avail: NTIS HC A17/MF A01

N86-27637# Nottingham Univ. (England).
HEAT TRANSFER MEASUREMENTS IN STEADY STATE FACILITIES
Nessim Hay *In* Von Karman Inst. for Fluid Dynamics Measurements Techniques in Turbomachines, Volume 2 1985 40 p (For primary document see N86-27631 18-37)
Avail: NTIS HC A17/MF A01

N86-27638# Nottingham Univ. (England).
THE SWOLLEN POLYMER TECHNIQUE
Nessim Hay *In* Von Karman Inst. for Fluid Dynamics Measurements Techniques in Turbomachines, Volume 2 1985 52 p (For primary document see N86-27631 18-37)
Avail: NTIS HC A17/MF A01

N86-27651*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SHUTTLE CONTINUOUS OPEN WIND TUNNEL (SCOWT)
Giovanni M. Carlomagno (Naples Univ. (Italy).), Luigi deLuca, Paul M. Siemers, and George M. Wood *In* NASA, Washington Applications of Tethers in Space. Workshop Proceedings, Vol. 2 Jun. 1986 p 225-249 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N86-27612*# Harvard Coll. Observatory, Cambridge, Mass. Center for Astrophysics.
PRELIMINARY EXPERIMENT REQUIREMENTS DOCUMENT FOR SOLAR AND TERRESTRIAL ATMOSPHERES SPECTROMETER (STAS)
May 1986 58 p Prepared in cooperation with Ball Aerospace Systems Div., Boulder, Colo.
(Contract NASw-3940)
(NASA-CR-177301; NAS 1.26:177301) Avail: NTIS HC A04/MF A01 CSCL 14B

The principal scientific objective of the Solar and Terrestrial Atmospheres Spectrometer (STAS) project is the measurement of the absolute ultraviolet solar spectral irradiance with: (1) resolution of better than 15 mA, and (2) absolute irradiance uncertainty at the state of the art (less than or equal to 3%). High measurement accuracy coupled with high spectral resolution are necessary to identify the nature of the radiation, its variability, and to identify solar processes which may cause the changes. Solar radiation between 1200 and 3600 A dominates the photochemistry of the mesosphere and stratosphere. Some important minor species, such as NO, show very complex and fundamentally narrow structure in their photodestruction cross sections, especially in the region of the Schumann-Runge bands of O2. Understanding the photochemical processes in the terrestrial atmosphere requires knowledge of both the cross sections and of the solar spectrum with the highest possible resolution and accuracy. Author

N86-27613# National Aeronautical Lab., Bangalore (India). Materials Science Div.
TEMPERATURE PROGRAMMER FOR THE TEFLON-CELL ARRANGEMENT IN HIGH PRESSURE STUDIES
V. Shubha and T. G. Ramesh Mar. 1986 16 p
(NAL-TM-MT-8602) Avail: NTIS HC A02/MF A01

A precision analog temperature programmer is presented for use with the teflon cell technique which is extensively used in high pressure studies. The stability of temperature control is within + or - 0. 1 deg. C of the set point value. Linear temperature versus time ramps selectable from 1 deg. C/minute to 20 deg. C/minute is also possible in this system. This instrument facilitates automatic data acquisition of electronic transport properties under high pressure conditions. Author

N86-27614# Electrotechnical Lab., Ibaraki (Japan).
RESEARCH ON TESTING METHODS OF SOUND LEVEL METERS
Moriyasu Minakawa, Hajime Tomioka, Kihachi Mutoh, and Hajime Miura Dec. 1985 66 p In JAPANESE; ENGLISH summary
(EL-862; ISSN-0366-9106; UDC-534.322:53.089.6) Avail: NTIS HC A04/MF A01

Testing and calibrating methods for sound level meters were described according to the Measurement Law as well as the Japanese Industrial Standards. Testing methods developed for the establishment of the inspection system of sound level meters were based on high technologies, such as digitalized signal sources f and automated testing systems using minicomputers and microcomputers. Two types of sound level meters were examined: JIS C1502-1977 and JIS C1505-1977. B.G.

N86-27615# National Aeronautical Lab., Bangalore (India). Materials Science Div
ANALOG LINEARISING CIRCUITRY FOR THERMOCOUPLES
V. Shubha and T. G. Ramesh May 1986 12 p

(NAL-TM-MT-8608) Avail: NTIS HC A02/MF A01

An analog fourth order polynomial curve fitting circuit was designed to linearize the thermocouple voltages of standard thermocouples. Typical design data and performance of the circuit is illustrated for the Type K thermocouple. This circuit can also be used to linearize the outputs of other types of transducers and simulate nonlinear variations with temperature of the physical quantities like absolute thermoelectric power of chromel and alumel. Author

N86-27616*# Arizona Univ., Tucson. Lunar and Planetary Lab.
DEISGN STUDY OF AN ENTRY PROBE SPECTRO-REFLECTOMETER Final Report, Sep. 1982 - Sep. 1983
Godfrey T. Sill and Uwe Fink 14 Jul. 1986 11 p
(Grant NAGw-248)
(NASA-CR-177278; NAS 1.26:177278) Avail: NTIS HC A02/MF A01 CSCL 14B

A wind tunnel was built to simulate the rapid movement of an entry probe through the Jupiter atmosphere. Wind speeds range from 1 to 50 meters per second in a closed system. Wind velocity and temperature probes as well as a cryogenically cooled cold finger can be placed in the 6 inch diameter viewing section. The initial testing of the wind tunnel involved running sectional profiles through the observation port of air currents of 0.1 to 3.0 atmosphere. The velocity profile was very uniform throughout the cross section of the experimental port, with the exception of the wall effects. The deposition of cooled volatiles using the wind tunnel was not performed. However, measurements of the deposition of H2O ice on a cryogenically cooled thickness modulator were made under ambient conditions, namely room temperature and pressure. In the Frost Depositon Test Facility, ice deposition was measured at thicknesses of about a half millimeter and frost was produced whose thickness reflectivity could easily be measured by reflectance spectroscopy. B.G.

N86-27617*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IDENTIFICATION OF DIFFERENCES BETWEEN FINITE ELEMENT ANALYSIS AND EXPERIMENTAL VIBRATION DATA
Charles Lawrence Jun. 1986 33 p
(NASA-TM-87336; E-3082; NAS 1.15:87336) Avail: NTIS HC A03/MF A01 CSCL 14B

An important problem that has emerged from combined analytical/experimental investigations is the task of identifying and quantifying the differences between results predicted by F.E. analysis and results obtained from experiment. The objective of this study is to extend and evaluate the procedure developed by Sidhu for correlation of linear F.E. and modal test data to include structures with viscous damping. The desirability of developing this procedure is that the differences are identified in terms of physical mass, damping, and stiffness parameters instead of in terms of frequencies and modes shapes. Since the differences are computed in terms of physical parameters, locations of modeling problems can be directly identified in the F.E. model. From simulated data it was determined that the accuracy of the computed differences increases as the number of experimentally measured modes included in the calculations is increased. When the number of experimental modes is at least equal to the number of translational degrees of freedom in the F.E. model both the location and magnitude of the differences can be computed very accurately. When the number of modes is less than this amount the location of the differences may be determined even though their magnitudes will be under estimated. Author

N86-27618*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CRYOGENIC STRAIN GAGE TECHNIQUES USED IN FORCE BALANCE DESIGN FOR THE NATIONAL TRANSONIC FACILITY
Alice T. Ferris May 1986 15 p
(NASA-TM-87712; NAS 1.15:87712) Avail: NTIS HC A02/MF A01 CSCL 14B

A force balance is a strain gage transducer used in wind tunnels to measure the forces and moments on aerodynamic models. Techniques have been established for temperature-compensation of force balances to allow their use over the operating temperature range of a cryogenic wind tunnel (-190C to 60C) without thermal control. This was accomplished by using a patented strain gage matching process to minimize inherent thermal differences, and a thermal compensation procedure to reduce the remaining thermally-induced outputs to acceptable levels. A method of compensating for mechanical movement of the axial force measuring beam caused by thermally-induced stresses under transient temperatures was also included. Author

N86-27619# Army Research Inst. of Environmental Medicine, Natick, Mass.
AUTOMATED DATA COLLECTION AND PROCESSING FOR A CONCENTRIC/ECCENTRIC CYCLE ERGOMETER
Everett Harman, Howard G. Knuttgen, and Peter Frykman Feb. 1986 28 p
(AD-A165025; USARIEM-M-16/86) Avail: NTIS HC A03/MF A01 CSCL 14/2

A system for collection and processing of data from a concentric/eccentric high intensity cycle ergometer is described. Each cycle pedal is fitted with transducers to measure pedal angle relative to the crank and foot forces both perpendicular and parallel to the pedal surface. An additional transducer monitors crank position. Output signals are conditioned, amplified, digitized by a 12 bit A/D converter, fed into a computer at 100 Hz per channel, and mathematically smoothed to attenuate noise. For each sample interval, foot force components perpendicular and parallel to the crank arm are calculated. Power generated by subjects on each crank revolution is determined from transducer information. Computer graphics display pedalling parameters vs. crank angle in both rectangular and circular format. Data files containing variables descriptive of pedalling parameter curves are produced to enable computerized statistical analysis of cycling performance. Author (GRA)

N86-27620# Department of the Navy, Washington, D. C.
HIGH FREQUENCY RESPONSE MULTILAYER HEAT FLUX GAUGE Patent Application
Alan H. Epstein, Gerald R. Guenette, and Robert J. Norton, inventors (to Navy) Filed 28 May 1985 46 p
(AD-D012181; US-Patent-Appl-SN-738217) Avail: NTIS HC A03/MF A01 CSCL 14/2

This patent application discloses a double sided, high frequency response heat flux gauge for use on metal turbine blading consisting of a metal film resistance thermometer sputtered on both sides of a thin (25 micrometer) polyimide sheet. The temperature difference across the polyimide is a direct measure of the heat flux at low frequencies, while a quasi-ID analysis is used to infer the high frequency heat flux from the upper surface history. GRA

N86-27621# Varian Associates, Palo Alto, Calif.
RECENT OPERATING EXPERIENCE WITH VARIAN 70 GHz AND 140 GHz GYROTRONS
K. Felch, R. Bier, L. Fox, H. Huey, L. Ives, H. Jory, N. Lopez, J. Shively, and S. Spang 1985 7 p Presented at the Course and Workshop on Applications of RF Waves To Tokamak Devices, Varenna, Italy, 5 Sep. 1985
(Contract DE-AC05-84OR-21400)
(DE86-003099; CONF-8509192-3) Avail: NTIS HC A02/MF A01

The design features and initial test results of Varian 70 GHz and 140 GHz CW gyrotrons are presented. The first experimental 140 GHz tube has achieved an output power of 102 kW at 24% efficiency under pulsed conditions in the desired TE sup o sub 031 cavity mode. Further tests aimed at achieving the design goal of 100 kW CW are currently under way. The 70 GHz tube has achieved an output power of 200 kW under pulsed conditions and possesses a wide dynamic range for output power variations. DOE

N86-27622# Lawrence Livermore National Lab., Calif.
OPERATION OF COLD-CATHODE GAUGES IN HIGH MAGNETIC FIELDS

S. R. Thomas, Jr., D. A. Goerz, and W. L. Pickles 11 Nov. 1985 6 p Presented at the 32nd National Vacuum Symposium and Topical Conference, Houston, Tex., 19 Nov. 1985
(Contract W-7405-eng-48)
(DE86-003489; UCRL-92741; CONF-851174-22) Avail: NTIS HC A02/MF A01

The Mirror Fusion Test Facility (MFTF-B), under construction at LLNL, requires measurement of the neutral gas density in high magnetic fields near the plasma at several axial regions. This Background Gas Pressure (BGP) diagnostic will help us understand the role of background neutrals in particle and power balance, particularly in the maintenance of the cold halo plasma that shields the hot core plasma from the returning neutrals. It consists of several cold-cathode, magnetron-type gauges stripped of their permanent magnets, and utilizes the MFTF-B ambient B-field in strengths of 5 to 25 kG. Similar gauges have operated in TMX-U in B-fields up to 3 kG. To determine how well the gauges will perform, we assembled a test stand which operated magnetron gauges in an external, uniform magnetic field of up to 30 kG, over a pressure range of 1E-8 T to 1E-5 T, at several cathode voltages. This paper describes the test stand and presents the results of the tests. DOE

N86-27623# Sandia National Labs., Albuquerque, N. Mex.
MINIMIZATION OF OPERATOR-BALANCE INTERACTIVE WARMUP BY USE OF AN ALTER EGO HEAT SOURCE
D. W. Braudaway 1986 13 p Presented at the IEEE Conference on Instrumentation and Measurements, Boulder, Colo., 25 Mar. 1986
(Contract DE-AC04-76DP-00789)
(DE86-004221; SAND-85-1983C; CONF-860354-1) Avail: NTIS HC A02/MF A01

Operator-equipment interaction is a well-known but frustrating part of many high precision measurements. Deterioration in performance of a high-precision balance required testing to identify the cause of the problem and to establish effectiveness of the solution. An unexpected result of the tests was a clear characterization of a significant operator-balance thermal interaction and verification of the empirically determined warmup requirement. The repeatability of the interactive effect inspired development of a replacement for the operator using an alter ego heat source. DOE

N86-27624# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
PRINCIPLES AND APPLICATIONS OF THE FOKKER BOND TESTER
Jos J. C. Caarls, Rolf J. Querido, and Alan G. Julier 1985 21 p Presented at Air Transport Association of America Nondestructive Testing Forum, Miami, Fla., 17-20 Sep. 1985
(Contract BMFT-0101-ZA/WF/WRD-174/4)
(ESA-86-96960) Avail: NTIS HC A02/MF A01

An instrument for testing adhesive bonding of aircraft structures is described. Factors determining bond strength; principle of operation; and the use of correlation charts are discussed. Automation and improvements to the instrument since its introduction are outlined. ESA

N86-27625# National Physical Lab., Teddington (England). Div. of Material Applications.
BACKGROUND DISCUSSION PAPER FOR THE DEVELOPMENT OF R AND D STRATEGY IN THE AREA OF JOINING TECHNOLOGY
L. N. McCartney 1985 634 p
(PB86-178399; NPL-DMA(A)-110) Avail: NTIS HC A04/MF A01 CSCL 14B

In response to a request from the Non-Metallic Materials and Chemicals Committee (NMMCC) of the Materials, Chemicals and Vehicles Requirements Board of the DTI, the NPL have prepared a background paper on joining technology which reviews progress to date and highlights some of the challenges for the future. The uses of composite materials, ceramics, plastics and adhesives in manufacturing industry are reviewed and the importance of joining technology to their application is emphasized. GRA

N86-27313*# Purdue Univ., West Lafayette, Ind. Getaway Special Group.
DESIGN CONSIDERATIONS FOR A GAS MICROCONTROLLER
Douglas A. Ritter *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 117-124 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27316*# Kayser Threde G.m.b.H., Munich (West Germany).
HALOGEN LAMP EXPERIMENT, HALEX
Gunter Schmitt and Jurgen Stapelmann (Dornier-Werke G.m.b.H., Friedrichshafen, West Germany) *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 141-149 (For primary document see N86-27297 18-12)
Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27493# Joint Publications Research Service, Arlington, Va.
CY SERIES INTEGRATED PRESSURE TRANSDUCER
Minhang Bao and Jishen Jiang *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 141-147 Transl. into ENGLISH from Dianzi Kexue Jishu (Beijing, China), no. 12, 10 Dec. 1984 p 25-26, 28 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27502# Joint Publications Research Service, Arlington, Va.
IMAGING EQUATION, OPTIMUM ESTIMATION, ALGORITHM OF ULTRASONIC HOLOGRAPHY
Zaiming Li and Junti Wu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 —p 43-51 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 13, no. 3, May 1985 p 71-76 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

N86-27507# Joint Publications Research Service, Arlington, Va.
OPTICAL DISK MEDIA RESEARCH DISCUSSED
Jinchun Hou and Fuxi Gan *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 96-110 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 12, p 705-712 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N86-27626# Impulse Engineering, Inc., New Haven, Conn.
LONG-LIFE, REPETITIVE-PULSE SWITCH FOR LASERS Final Report, Sep. 1982 - Jun. 1985
D. Turnquist Dec. 1985 48 p
(Contract F33615-82-C-2243)
(AD-A164879; AFWAL-TR-85-2084) Avail: NTIS HC A03/MF A01 CSCL 09/1

This program is the first phase of the development of a scalable, long life, high pressure, closing switch for use in repetitively pulsed high voltage systems. The objectives were to develop a conceptual switch design and to perform experiments to establish the feasibility of the switch for varying voltage/pulse life. To fulfill the requirements a switch was conceived with the features of: a high pressure gas fill, for high voltage holdoff and fast current rise; a discharge formation control scheme to generate a uniform discharge that will minimize filamentation and arcing; a linear (50 to 100 cm length) geometry compatible with transverse-discharge lasers. The first part of this program was directed toward delineation of the important switch design parameters and toward the design of the experimental switch. Areas reviewed for the first part were uniform discharge growth at high pressure, basic data for the gases under consideration, and preionization ion density requirements. For the second part of the program an experimental device was built and

experiments were run to determine the switch characteristics.
GRA

N86-27627# Lawrence Livermore National Lab., Calif.
ECONOMIC REQUIREMENTS FOR COMPETITIVE LASER FUSION POWER PRODUCTION
W. J. Hogan and W. R. Meier 15 Nov. 1985 6 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985
(Contract W-7405-eng-48)
(DE86-003480; UCRL-92559; CONF-851102-47) Avail: NTIS HC A02/MF A01

An economic model of a laser fusion commercial power plant is used to identify the design and operating regimes of the driver, target and reaction chamber that will result in economic competitiveness with future fission and coal plants. We find that, for a plant with a net power of 1 GW(sub e), the cost of the driver must be less than $0.4 to 0.6 B, and the recirculating power fraction must be less than 25%. Target gain improvements at low driver energy are the most beneficial but also the most difficult to achieve. The optimal driver energy decreases with increasing target technology. The sensitivity of the cost of electricity to variations in cost and performance parameters decreases with increasing target technology. If chamber pulse rates of a few Hz can be achieved, then gains of 80 to 100 will be sufficient, and higher pulse rates do not help much. Economic competitiveness becomes more difficult with decreasing plant size. Finally, decreasing the cost of the balance of plant has the greatest beneficial effect on economic competitiveness. DOE

N86-27628# Sandia National Labs., Albuquerque, N. Mex.
RECENT RESULTS FROM NUCLEAR PUMPED LASER STUDIES: GAIN MEASUREMENTS IN XeF
G. N. Hays, D. A. McArthur, D. A. Neal, and J. K. Rice 1985 10 p Presented at the International Laser Science Conference, Dallas, Tex., 18 Nov. 1985
(Contract DE-AC04-76DP-00789)
(DE86-004557; SAND-85-2214C; CONF-851185-3) Avail: NTIS HC A02/MF A01

Nuclear pumped lasers are the subjects studied. Gain measurements on the XeF(B-X) transition near 351 mm in He/Xe/NF gas mixtures pumped by fission fragments originating from thermal neutron impact of He are presented. DOE

N86-27485# Joint Publications Research Service, Arlington, Va.
CONFOCAL LASER RESONATOR CHARACTERISTICS ANALYZED
Deyun Jin *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 75-80 Transl. into ENGLISH from Guangxue Xuebao (Acta Optica Sinica) (Shanghai, China), v. 5, no. 11, Nov. 1985 p 992-996 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27486# Joint Publications Research Service, Arlington, Va.
CHINESE ACADEMY OF SCIENCES STUDIES DH LASER
Qiming Wang *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 81-92 Transl. into ENGLISH from Tongxin Xuebao (Beijing, China), v. 6, no. 1, Jan. 1985 p 65-70 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27487# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF SECTIONAL CONSTRICTED PLANAR CO-CAVITY DH LASERS
Guotong Du, Deling Yang, and Dingsan Gao *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 93-96 Transl. into ENGLISH from Bandaoti Xuebao (Beijing, China), v. 6, no. 4, Jul. 1985 p 442-445 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27506# Joint Publications Research Service, Arlington, Va.
FIRST FREE-ELECTRON LASER OPERATIONAL
Cheng Zhu, Zaitong Lu, Ruigen Shi, Zhijiang Wang, Jinchuan Shi, and Yu Hu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 —p 95 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 12, p 787 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

N86-27508# Joint Publications Research Service, Arlington, Va.
LASER PULSE COMPRESSOR AND PHASE-COMPENSATOR DESCRIBED
Cunkai Wu, Guang Lan, Jie Xu, and Guozheng He *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 115-117 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 12, 20 Dec. 1985 p 750-751 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

N86-27509# Joint Publications Research Service, Arlington, Va.
STANDING WAVE WIGGLERS USED IN FREE-ELECTRON LASER
Shizhan Lei *In its* China Report: Science and technology (JPRS-CST-86-009) 13 Mar. 1986 p 118-123 Transl. into ENGLISH from Hongwai Yanjiu (Shanghai, China), v. 4, no. 5, Oct. 1985 p 374-378 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

N86-27510# Joint Publications Research Service, Arlington, Va.
THE (SUP)14 CO (SUB)2 ISOTOPE LASER DESCRIBED
Lin Fei, Kejun Wang, and Zuhui Zhu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 124-130 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 9, 20 Sep. 1985 p 524-527 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

N86-27511# Joint Publications Research Service, Arlington, Va.
AUTO-ALIGNMENT DEVELOPED FOR LARGE LASER SYSTEM
Wucheng Wang, Jianxiong Wang, Hengxian Wu, Ruoju Guo, Jingxin Yang, and Shiyuan Hu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 131-139 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 9, Sep. 1985 p 542, 543-546 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N86-27629* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LOAD POSITIONING SYSTEM WITH GRAVITY COMPENSATION
Richard H. Hollow 12 Dec. 1984 9 p
(NASA-Case-ARC-11525-1; US-Patent-4,591,772;
US-Patent-Appl-SN-681041; US-Patent-Class-318-632;
US-Patent-Class-318-8; US-Patent-Class-318-48;
US-Patent-Class-318-663) Avail: US Patent and Trademark Office CSCL 13I

A load positioning system with gravity compensation has a servomotor, position sensing feedback potentiometer and velocity sensing tachometer in a conventional closed loop servo arrangement to cause a lead screw and a ball nut to vertically position a load. Gravity compensating components comprise the DC motor, gears, which couple torque from the motor to the lead screw, and constant current power supply. The constant weight of the load applied to the lead screw via the ball nut tend to cause the lead screw to rotate, the constant torque of which is opposed by the constant torque produced by the motor when fed from the constant current source. The constant current is preset as required by the potentiometer to effect equilibration of the load which thereby

enables the positioning servomotor to see the load as weightless under both static and dynamic conditions. Positioning acceleration and velocity performance are therefore symmetrical. NASA

N86-27630* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OPTIMIZED BOLTED JOINT Patent
Leonard J. Hart-Smith (McDonnell-Douglas Corp., Long Beach, Calif.), Bruce L. Bunin, and Donald J. Watts, inventors (to NASA) Issued 1 Apr. 1986 9 p Filed 23 Jan. 1984 Supersedes N84-20859 (22 - 11, p 1664) Sponsored by NASA. Langley Research Center (NASA-Case-LAR-13250-1; US-Patent-4,579,475; US-Patent-Appl-SN-573162; US-Patent-Class-403-312; US-Patent-Class-403-388; US-Patent-Class-403-408.1) Avail: US Patent and Trademark Office CSCL 13I

A method is disclosed for joining segments of the skin of an aircraft. The ends of the skin are positioned in close proximity or abutt each other. The skin is of constant thickness throughout the joint and is sandwiched between splice plates, which taper in thickness from the last to the first bolt rows in order to reduce the stiffness of the splice plate and thereby reduce the load transfer at the location where bypass loads are the highest.
Official Gazette of the U.S. Patent and Trademark Office

N86-27631# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
MEASUREMENTS TECHNIQUES IN TURBOMACHINES, VOLUME 2
1985 385 p Lecture series held in Rhode-Saint-Genese, Belgium, 25 Feb. - 1 Mar. 1985
(VKI-LS-1985-03-Vol-2; ESA-85-95398) Avail: NTIS HC A17/MF A01

Design, development and operation of a high simultaneous capacity digital telemetry system for gas turbine studies; hot-wire anemometry in turbomachinery components (measurements with stationary hot-wire probes, application of hot-wires in the relative frame of reference); measurements in two-phase flows; short duration heat transfer measurements; and heat transfer measurements in steady state facilities were discussed. For individual titles, see N86-27632 through N86-27638.

N86-27632# Rolls-Royce Ltd., Derby (England).
DESIGN, DEVELOPMENT AND OPERATION OF A HIGH SIMULTANEOUS CAPACITY DIGITAL TELEMETRY SYSTEM
K. Bradley *In* Von Karman Inst. for Fluid Dynamics Measurements Techniques in Turbomachines, Volume 2 1985 32 p (For primary document see N86-27631 18-37)
Avail: NTIS HC A17/MF A01

A digital telemetry system for measuring pressures in interblade passages on large fan engines and model fan rigs was developed. The telemetry system replaces the slip-rings used in previous tests, and incorporates on rotor digitization and hybrid circuit techniques. Simultaneous cpacity is 48 measurements, in the dc to 3 kHz bandwidth. Measurement accuracy is + or - 0.5% fsd (dc) to 1.0% fsd (ac). Dynamic range is 60 dB. Input sensitivity is 0 to 80 mV for 0 to 25 psia. Applications are to an RB 211 development engine and a model scale fan rig. Engine shaft speed is 3900 rpm, rig speed is 10,000 to 11,000 rpm. Author (ESA)

N86-27633# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
HOT-WIRE ANEMOMETRY IN TURBOMACHINERY COMPONENTS
K. Mathioudakis and F. A. E. Breugelmans *In its* Measurements Techniques in Turbomachines, Volume 2 1985 50 p (For primary document see N86-27631 18-37)
Avail: NTIS HC A17/MF A01

Techniques for measurements in turbomachinery employing stationary hot-wire probes are presented. Single slanted hot-wires can measure the three dimensional mean and turbulent flow fields. Their use can become tedious if large amounts of data have to be taken. They cannot provide instantaneous signals of velocity magnitude and direction. Use of crossed hot-wires should be restricted to two dimensional flow conditions and particularly to mean flow measurements. The combination of three wires to form triple sensor probes is the most powerful instrument for three dimensional mean velocity and turbulence measurements. Methods employing such probes are described. Author (ESA)

N86-27634# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
APPLICATION OF HOT WIRES IN THE RELATIVE FRAME OF REFERENCE
F. A. E. Breugelmans *In its* Measurements Techniques in Turbomachines, Volume 2 1985 68 p (For primary document see N86-27631 18-37)
Avail: NTIS HC A17/MF A01

Hot-wire techniques for studying flow phenoma in the rotating channel and near the blade surfaces of turbomachines are reviewed. Instruments for flow reversal investigations (i.e., sensors based on the thermal tuft technique); sensors for flow direction measurements on the blade surface; and probes for channel flow exploration are discussed. The rotor boundary layer longitudinal and crossflow profiles; the three dimensional structure of the wake; tip leakage flow; flow separation; stall; and surge are discussed. Author (ESA)

N86-27635# Ecole Royale Militaire, Brussels (Belgium).
MEASUREMENTS IN TWO-PHASE FLOWS c34
R. Decuypere *In* Von Karman Inst. for Fluid Dynamics Measurements Techniques in Turbomachines, Volume 2 1985 92 p (For primary document see N86-27631 18-37)
Avail: NTIS HC A17/MF A01

Laser transit velocimetry (LTC) measurements of turbomachine flows are introduced. Droplet size and wetness measurements are described. With the backscattering LTV, no seeding is required to study two phase flows. It is less sensitive than laser doppler anemometers to dirty windows, although dirt reduces signal quality for measurements within 3 mm of the window. For flows with high angular turbulence levels the laser doppler velocimeter must be used. Author (ESA)

N86-27636# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
SHORT DURATION HEAT TRANSFER MEASUREMENTS c34
Tony Arts and Cengiz Camci *In its* Measurements Techniques in Turbomachines, Volume 2 1985 50 p (For primary document see N86-27631 18-37)
Avail: NTIS HC A17/MF A01

Shock tunnels, blowdown cascades, and isentropic light piston compression tubes used to study heat transfer and aerodynamic phenomena in turbine components are described. Thin film heat transfer gages, calorimeter gages, and optical measurements methods are presented. Compression tube investigations of convective heat transfer on a flat plate, with and without film cooling; and convective heat transfer on a high pressure rotor blade with and without film cooling are summarized. Results show that along the suction side, laminar to turbulent transition is strongly influenced by the presence of the leading edge cooling holes, even when no coolant flow is ejected. Along the pressure side, the boundary layer behavior is dominated by the free stream pressure gradient rather than by the existence of the cooling holes. Significant coolant temperature effects are also observed. At low blowing rate this effect is mainly observed up to 35 to 40 hole diameters downstream of the suction side ejection rows when the coolant temperature is lowered from wall temperature to half of the mainstream level. At high blowing rate, the influence of the coolant temperature is felt much further downstream.
Author (ESA)

N86-27637# Nottingham Univ. (England).
HEAT TRANSFER MEASUREMENTS IN STEADY STATE FACILITIES c34
Nessim Hay *In* Von Karman Inst. for Fluid Dynamics Measurements Techniques in Turbomachines, Volume 2 1985 40 p (For primary document see N86-27631 18-37)

Avail: NTIS HC A17/MF A01

Heat transfer measurement techniques used to study gas turbines, particularly blade cooling, are reviewed. Surface temperature methods; transient methods; pulse methods; and mass transfer analogy methods are covered. Promising techniques for steady state facilities include infrared camera system for low and high temperature tests; pulse methods for full scale tests; and the swollen polymer technique for fundamental investigations under ambient conditions. Author (ESA)

N86-27638# Nottingham Univ. (England).
THE SWOLLEN POLYMER TECHNIQUE **c34**
Nessim Hay *In* Von Karman Inst. for Fluid Dynamics Measurements Techniques in Turbomachines, Volume 2 1985 52 p (For primary document see N86-27631 18-37)
Avail: NTIS HC A17/MF A01

The swollen polymer technique for measuring heat transfer in gas turbine steady state facilities is described. It is a combination of the swollen polymer approach to mass transfer and laser holographic interferometry. The former is used in place of the sublimating naphthalene surface and the latter replaces the associated mechanical profilometric measurements with optical measurements. Application to the measurement of adiabatic wall effectiveness on film cooled surfaces is outlined. Author (ESA)

N86-27639# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
MEASUREMENT TECHNIQUES IN TURBOMACHINES, VOLUME 1
1985 402 p Lecture series held in Rhode-Saint-Genese, Belgium, 25 Feb. - 1 Mar. 1985
(VKI-LS-1985-03-Vol-1; ESA-85-95397) Avail: NTIS HC A18/MF A01

The Von Karman Institute for Fluid Mechanics sponsored a lecture series on Techniques in Turbomachines, which took place in Rhode Saint Genese, Belguim, on 25 February - I March I985. Among the topics discussed were the following: the application of laser anemometry to turbomachinery flow field measurements; high frequency response measurement in turbomachinery; and optical techniques in turbomachinery. For individual titles, see N86-27640 through N86-27642.

N86-27640*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF LASER ANEMOMETRY TO TURBOMACHINERY FLOW FIELD MEASUREMENTS
Anthony J. Strazisar *In* Von Karman Inst. for Fluid Dynamics Measurement Techniques in Turbomachines, Volume 1 1985 122 p (For primary document see N86-27639 18-37)
Avail: NTIS HC A18/MF A01

The application of laser anemometry to the measurement of turbomachinery flow fields is reviewed. Choices of optical configuration, seed particle generation, and seed injection techniques are discussed. The modification of experimental facilities to gain optical access is considered. The efficiency of data acquisition schemes is analyzed and issues related to data integrity and error estimation are addressed. Data reduction and analysis techniques for extracting and understanding the flow physics from laser anemometer measurements are presented. Author (ESA)

N86-27641# Massachusetts Inst. of Tech., Cambridge. Gas Turbine Lab.
HIGH FREQUENCY RESPONSE MEASUREMENTS IN TURBOMACHINERY
Alan H. Epstein *In* Von Karman Inst. for Fluid Dynamics Measurement Techniques in Turbomachines, Volume 1 1985 104 p (For primary document see N86-27639 18-37)
Avail: NTIS HC A18/MF A01

The design, construction, and use of multitransducer probes for the measurement of total and static pressures and flow angles in turbomachinery are discussed. Physical constraints on probe frequency response and tradeoffs in spatial resolution are presented. Probe use and calibration are illustrated in a conventional steady state compressor test rig. The determination of fluctuating temperature in a high speed flow field by hot wire anemometry is reviewed. A technique using a multisensor aspirating probe to simultaneously measure time resolved total pressure and temperature is presented. The calibration techniques for the aspirating probe are compared to those for multisensor pressure probes. Use of the aspirating probe in transonic turbomachinery is illustrated. Author (ESA)

N86-27642# TopExpress Ltd., Cambridge (England).
OPTICAL TECHNIQUES IN TURBOMACHINERY
P. J. Bryanston-Cross *In* Von Karman Inst. for Fluid Dynamics Measurement techniques in Turbomachines, Volume 1 1985 161 p (For primary document see N86-27639 18-37)
Avail: NTIS HC A18/MF A01

Turbomachine flow analysis using shadowgraphy; Schlieren photography; moire interferometry; holography; smoke visualization; particle seeding; Mie scattering; pulse laser velocimetry (PLV); speckle interferometry; heat mass transfer analogies; fluorescence; and photography is illustrated. Author (ESA)

N86-27643*# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
SSME LONG-LIFE BEARINGS Final Report, Jan. 1982 - July 1986
Myles F. Butner and Brian T. Murphy Jul. 1986 163 p
(Contract NAS3-23623)
(NASA-CR-179455; NAS 1.26:179455; RI/RD86-168) Avail: NTIS HC A08/MF A01 CSCL 13I

Hybrid hydrostatic/ball bearings for LH2 and LO2 service in turbopumps were studied as a means of improving speed and life capabilities. Four hybrid bearing configurations were designed with emphasis on achieving maximum stiffness and damping. Parallel load bearings were tested at steady-state and transient conditions with LH2 (externally fed) and LN2 (internally fed). The hydrostatic elements were tested with Freon 113 for empirical determination of dynamic characteristics. Tests using an eccentric journal for loading showed the externally and internally fed hydrostatic bearings to have significant separated coefficients of direct stiffness and damping. For the internally fed bearing, the strongly speed-dependent cross-coupling stiffness arising from fluid swirl, along with significant cross-coupling damping, resulted in low net effective stiffness and damping. The test method used can produce separated coefficients with a sufficiently elliptic journal orbit; otherwise, only net effective coefficients combining direct and cross-coupling terms can be determined. Testing with nonsynchronous excitation is recommended to avoid this restriction. Investigation of hard materials, including ceramics, is recommended as a means of eliminating the need for the rolling bearing for startup and shutdown support. The testing was performed in 1984 (LH2), 1985 (LN2) and 1985-86 (Freon). Author

N86-27644*# National Aeronautics and Space Administration, Washington, D.C.
APPLICATIONS OF TETHERS IN SPACE: WORKSHOP PROCEEDINGS, VOLUME 2
William A. Baracat, comp. (General Research Corp., McLean, Va.) Jun. 1986 502 p Workshop held in Venice, Italy, 15-17 Oct. 1985; sponsored by NASA, the Italian National Space Plan and CNR
(Contract NASw-3921)
(NASA-CP-2422-Vol-2; NAS 1.55:2422-Vol-2) Avail: NTIS HC A23/MF A01 CSCL 13I

Topics addressed include: tethered orbital transfer vehicle operations, Centaur and Shuttle tether technology; tethered constellations, gravitational effects; Shuttle continuous open wind tunnel; optimal control laws, electrodynamic tether technology; and space station facilities. For individual titles, see N86-27645 through N86-27660.

N86-27645*# Naples Univ. (Italy).
TETHERED CONSTELLATIONS, THEIR UTILIZATION AS MICROGRAVITY PLATFORMS AND RELEVANT FEATURES **c18**

Luigi G. Napolitano and Franco Bevilacqua (Aeritalia S.p.A., Torino (Italy).) *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 2 Jun. 1986 p 65-77 Previously announced in IAA as A85-13279 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The gravitational, thermal, and dynamic docking effects on tethered platforms were studied. The near-earth environment has gravitational effects such a g-jitters and intermittencies, g-noise, and frequency and amplitude features which may influence life science, materials processing, and fluid processes research and commercial activities. Artificial gravity is produced by minute accelerations imparted by tethers. The magnitudes of gravitational forces produced by tethers 100 and 100,000 m long at various altitudes from 463 to 35,786 km are calculated. Thermal analyses were performed for stainless steel and Kevlar tethers, showing the steel tether could vary 300 m in length and the polyamide 25 m during one orbit. Finally, consideration given to docking with a tethered platform revealed that the center of mass could change, which would produce, however, negligible changes in orbit and therefore gravity. M.S.K. (IAA)

N86-27646*# Alabama Univ., Huntsville.
ARTIFICIAL OR VARIABLE GRAVITY ATTAINED BY TETHER SYSTEMS c18
Charles A. Lundquist *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 79-86 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The simplest orbiting tethered system demands for stability that the mass centers of two end bodies be displaced above and below the position of zero acceleration. Therefore, the contents of the end bodies are subjected necessarily to acceleration fields or artificial gravity whose magnitudes depend on the dimensions and masses of the system. If the length of the tether changes, so do the fields. Even for a fixed tether length, the acceleration field at a location in the system may be somewhat variable unless special means are employed to maintain a constant value. These fundamental properties of a tethered system can be used to advantage if small or variable acceleration fields are desired for experimental or operational reasons. This potential use involves a few expressions from a formulation of tether system dynamics. Some of these formulae were collected for convenient use. Two and three body tethered equilibrium equations are explained. A special application of acceleration field control using a tether system is attainment of near-zero gravity. In this applicaition, even small variations about zero become a critical matter. Author

N86-27647*# Martin Marietta Corp., Denver, Colo.
TETHERED ORBITAL REFUELING STUDY c18
Dale A. Fester *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 89-123 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

Objectives are to evaluate the feasibility and limitations of fluid acquisition and transfer under an accleration induced in a tethered orbital refueling facility and to provide conceptual designs. Program tasks consist of recommendation of fluid transfer method and parameters; evaluation of disturbances, fluid motion, and damping; selection of passive devices to augment inherent fluid damping and determination of the resultant envelope of operation; assessment of the effect of tether lengths on hazards; and identification of ground and flight tests necessary to prove the tethered orbital refueling concepts. B.G.

N86-27648*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TETHERS AND GRAVITY IN SPACE c18
Paul A. Penzo *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 125-135 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The life science objectives concerning gravitational effects in space are summarized. The use of rotation, centrifuge, and tether techniques to produce variable gravity in space are presented. The station and tether platform concept are presented for the Gravlab design. B.G.

N86-27649*# Naples Univ. (Italy). Istituto Aerodinamica U. Nobile.
TETHERED ELEVATOR: A UNIQUE OPPORTUNITY FOR SPACE PROCESSING c12
Rodolfo Monti *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 137-147 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The latest fluid dynamic and material science experiments in the microgravity environment have emphasized the importance of the residual gravity level and of the g-jitter on fluid physics phenomena. The tethered elevator presents the possibility of providing variable g-levels (both steady and g-jitter) around a very low steady g-level (that can be realized when the elevator is near the center of mass of the space station-tether complex). When positioning a variable periodic oscillation to the payload a clean g-jitter disturbance can be obtained that would not be otherwise obtainable by other systems. These two possibilities make the elevator a facility to help resolve a number of still open questions that are preventing wider utilization of the space environment in the microgravity area. B.G.

N86-27650*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DYNAMICS OF TETHERED CONSTELLATIONS IN EARTH ORBIT
Enrico Lorenzini *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 167-203 (For primary document see N86-27644 18-37)
(Contracts NAS8-35497; NAS8-36606; RH4-394019)
Avail: NTIS HC A23/MF A01 CSCL 13I

Topics covered include station keeping of single-axis and two-axis constellations; single-axis vertical constellations with low-g platform; single-axis vertical constellations with three masses; deployment strategy; and damping of vibrational modes. B.G.

N86-27651*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SHUTTLE CONTINUOUS OPEN WIND TUNNEL (SCOWT) c34
Giovanni M. Carlomagno (Naples Univ. (Italy).), Luigi deLuca, Paul M. Siemers, and George M. Wood *In* NASA, Washington Applications of Tethers in Space. Workshop Proceedings, Vol. 2 Jun. 1986 p 225-249 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The aerodynamic and heat transfer coefficients are studied within the range of thermo-fluid-dynamic conditions experienced by a satellite during Tethered Satellite System (TSS) atmospheric flights. The gasdynamic processes occuring downstream of the bow wave standing in front of the satellite are also studied. The knowledge of the chemistry and physics of the upper atmosphere related to satellite aerothermodynamics is furthered. The existence of an overshooting of the air drag coefficient of the sphere in the transition regime is validated. A complete set of measurements is performed in order to provide the data base to develop and validate theoretical models of free molecule transition flow fields. E.R.

N86-27652*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SHUTTLE TETHERED AEROTHERMODYNAMICS RESEARCH FACILTY (STARFAC) INSTRUMENTATION REQUIREMENTS c02
George M. Wood, Paul M. Siemers, Giovanni M. Carlomagno (Naples Univ. (Italy).), and John Hoffman (Texas Univ., Dallas.) *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 251-263 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The instrumentation requirements for the Shuttle Tethered

Aerothermodynamic Research Facility (STARFAC) are presented. The typical physical properties of the terrestrial atmosphere are given along with representative atmospheric daytime ion concentrations and the equilibrium and nonequilibrium gas property comparison from a point away from a wall. STARFAC science and engineering measurements are given as are the TSS free stream gas analysis. The potential nonintrusive measurement techniques for hypersonic boundary layer research are outlined along with the quantitative physical measurement methods for aerothermodynamic studies. E.R.

N86-27653*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SHUTTLE TETHERED AEROTHERMODYNAMICS RESEARCH FACILITY (STARFAC) c02
Paul M. Siemers, George M. Wood, and Henry Wolf *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 265-285 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The Earth's atmosphere from 90 km to 200 km provides the last aerothermodynamics frontier. Present NASA programs which require but also can provide an understanding of the aerodynamics and aerothermodynamics of the free molecule and transition flows that exist at these altitudes are the Aeroassisted OTV, Entry Research Vehicle and the Tethered Satellite. Each of these programs provides a unique opportunity to do flight research in the rarefied upper atmosphere. However, the Tethered Satellite Program provides, because of its capability to obtain global, in-situ, steady state data, the greatest potential to: (1)define the performance of aerodynamic shapes as a function of environmental characteristics (free molecule, transition, slip flow regimes); (2)define the characteristics of the upper atmosphere and the global variability of properties such as composition temperature, pressure and density. Such data are required to accomplish the systematic development and verification of analytical prediction techniques required to support advance configuration designs. Author

N86-27654*# Aeritalia S.p.A., Torino (Italy).
TETHER POINTING PLATFORM AND SPACE ELEVATOR MECHANISMS ANALYSIS OF THE KEY CONCEPTS FOR SATP AND SCALED SATP
E. Turci *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 287-324 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The key concepts for a scaled and full model Science and Applications Tethered Platform (SATP) are analysized. This includes a tether pointing platform and a space elevator. The mechanism concepts and technological solutions are given. The idea of the tether pointing platform mechanism is to control and stabilize the attitude of a platform by means of a movable tether. The idea of the space elevator mechanism for a scaled SATP is to drag the tether gripping it between two rotating wheels. E.R.

N86-27655*# Howard Univ., Washington, D. C. Dept. of Mechanical Engineering.
THE DEVELOPMENT OF OPTIMAL CONTROL LAWS FOR ORBITING TETHERED PLATFORM SYSTEMS
Peter M. Bainum *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 325-355 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

A mathematical model of the open and closed loop in orbit plane dynamics of a space platform-tethered-subsatellite system is developed. The system consists of a rigid platform from which an (assumed massless) tether is deploying (retrieving) a subsatellite from an attachment point which is, in general, offset from the platform's mass center. A Langrangian formulation yields equations describing platform pitch, subsatellite tetherline swing, and varying tether length motions. These equations are linearized about the nominal station keeping motion. Control can be provided by both modulation of the tether tension level and by a momentum type platform-mounted device; system controllability depends on the presence of both control inputs. Stability criteria are developed in terms of the control law gains, the platform inertia ratio, and tether offset parameter. Control law gains are obtained based on linear quadratic regulator techniques. Typical transient responses of both the state and required control effort are presented. Author

N86-27656*# British Columbia Univ., Vancouver.
EFFECTS OF DAMPING ON THE CONTROL DYNAMICS OF THE SPACE SHUTTLE BASED ON TETHERED SYSTEMS c16
V. J. Modi *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 357-382 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The analysis of the effects of damping on the control dynamics of the space shuttle based on tethered systems suggest that a relatively simple point mass model can provide useful information concering librational dynamics during development and retrieval of the tethered satellites. The results show that a nonlinear tension control strategy in conjunction with a suitable choice of gains and realistic damping can lead to stable retrieval maneuver with amplitudes in pitch and roll limited to acceptable values. Longitudinal and lateral vibrations of the tether are strongly coupled and can lead to the slackening of the tether. Tether vibrations can be controlled quite effectively by speeding up the retrieval at smaller tether length and/or using thruster. E.R.

N86-27657*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRODYNAMIC TETHER TECHNOLOGY CONSIDERATIONS
Joseph C. Kolecki *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 383-386 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The electrodynamic tether operation was studied. Plasma contactors, power management and conditioning, and exposure of materials were considered. Multikilowatt electrodynamic tether systems need a variety of supporting technologies in order to be viable. The area of interface between the high voltage end of the electrodynamic tether and the user was not addressed, however, it must be in order for the successful and safe operation of the system. E.R.

N86-27658*# Contraves Italiana, Rome.
COMLINK PROPOSAL FOR FUTURE MISSIONS OF TETHERED SATELLITE c18
Filippo Sciarrino *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 387-398 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

The quality of the communications links between satellites was tested. The interaction between the VLF and ELF waves, generated by the conducting tether, and the SHF and YHF electromagnetic waves, generated by the 20/30 GHz transmitters were investigated. The ionspheric electron density irregularities was measured by means of phase-coherent RF transmission between the two vehicles. The motion of the tethered satellite was observed through the Doppler link established between the shuttle and the satellite. The technology and deployment of spaceborne antennas of large diameter was tested. E.R.

N86-27659*# Aeritalia S.p.A., Torino (Italy). Gruppo Sistemi Spaziali.
TETHERED ELEVATOR AND PLATFORMS AS SPACE STATION FACILITIES: SYSTEMS STUDIES AND DEMONSTRATIVE EXPERIMENTS c18
In NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 413-455 (For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

Several key concepts of the science and applications tethered platforms were studied. Some conclusions reached are herein

listed. Tether elevator and platform could improve the space station scientific and applicative capabilities. The space elevator presents unique characteristics as microgravity facility and as a tethered platform servicing vehicle. Pointing platforms could represent a new kind of observation facility for large class of payloads. The dynamical, control and technological complexity of these concepts advised demonstrative experiments. The on-going tethered satellite system offers the opportunity to perform such experiments. And feasibility studies are in progress. E.R.

N86-27660*# California Univ., La Jolla. Space Inst.
ROLES FOR TETHERS ON AN EVOLVING SPACE STATION
c18
Joseph A. Carroll *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Vol. 2 Jun. 1986 p 457-472
(For primary document see N86-27644 18-37)
Avail: NTIS HC A23/MF A01 CSCL 13I

A scenario was developed for evolution of space station tether capabilities. As tether imposed constaints on station developments and operations were minimized, maximum benefits were derived from a mutually compatible combination of: (1)electrodynamic tethers for power, thrust, and libration control; (2)momentum transfer operations involving the STS or upper stages; (3)aeromaneuvering devices for space station orbital plan change; and (4)tethered constellations and tether/free-flyer combinations. Some concepts determined for advance tether facilities orbiting the moon: (1)stationkeeping deltaVs to stay in precise equatorial or polar orbits; (2)ratio of facility mass to maximum payload mass (surface-orbit-escape); (3)electric-thruster power requirements and maximum rendezvous frequencies; and (4)overall capabilities and major constraints on such facilities. E.R.

N86-27661*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW METHODOLOGY FOR SHAFT DESIGN BASED ON LIFE EXPECTANCY
Stuart H. Loewenthal 1986 20 p Presented at the International Original Equipment Manufacturers Design Conference, New York, N.Y., 9-11 Dec. 1986
(NASA-TM-87354; E-3109; NAS 1.15:87354) Avail: NTIS HC A02/MF A01 CSCL 13I

The design of power transmission shafting for reliability has not historically received a great deal of attention. However, weight sensitive aerospace and vehicle applications and those where the penalties of shaft failure are great, require greater confidence in shaft design than earlier methods provided. This report summarizes a fatigue strength-based, design method for sizing shafts under variable amplitude loading histories for limited or nonlimited service life. Moreover, applications factors such as press-fitted collars, shaft size, residual stresses from shot peening or plating, corrosive environments can be readily accommodated into the framework of the analysis. Examples are given which illustrate the use of the method, pointing out the large life penalties due to occasional cyclic overloads. Author

N86-27662# Southampton Univ. (England). Inst. of Sound and Vibration Research.
POWER TRANSMISSION OF AN IDEALISED GEARBOX
R. C. N. Leung Nov. 1985 47 p Sponsored by Admiralty Research Establishment, Teddington, England
(ISVR-TR-131; ISSN-0347-6405; ESA-86-96843) Avail: NTIS HC A03/MF A01

The power transmission of a gearbox due to the in-plane vibration was studied. Results show that a journal bearing with a high eccentricity ratio has a smaller effect on the power transmission process than a journal bearing with a low eccentricity ratio. A journal bearing with a low eccentricity ratio acts as a dash pot at the low frequency range to dissipate the vibrational power. In the high frequency region, the dissipation process becomes less effective. Findings based on the results of the calculated power transmitted to the housing per unit excitation force at the rim are the same as those based on the power transmissibility of an idealized gearbox. The responses at the point of excitation for a rotating disk with a stationary excitation force were derived. ESA

N86-27663# Commerce Dept., Washington, D.C.
ROBOT END EFFECTOR Patent Application
A. Slocom, (inventors to Commerce) and P. Jurgens, (inventors to Commerce) Filed 13 Feb. 1986 19 p
(PB86-166042; US-Patent-Appl-SN-6-829052) Avail: NTIS HC A02/MF A01 CSCL 13I

The invention relates to manipulating devices, and in particular relates to an end effector or gripper attachable to a robot for mechanically grasping and orienting objects. GRA

N86-27664# Battelle Columbus Labs., Ohio.
TECHNOLOGY DEVELOPMENT FOR CORROSION-RESISTANT CONDENSING HEAT EXCHANGERS Final Report, Sep. 1984 - Oct. 1985
G. H. Stickford, B. Hindin, S. G. Talbert, A. K. Agrawal, and M. J. Murphy Oct. 1985 194 p
(PB86-172038; GRI-85/0282) Avail: NTIS HC A09/MF A01 CSCL 13A

The results of a study to develop technology to support gas appliance manufacturers in the selection of corrosion resistant materials for high efficiency, gas fired residential space heating equipment is presented. Condensate sampling during the 1984 to 1985 heating season has indicated that condensate chloride levels from indoor air combustion normally vary by 200 or 300 percent from week to week due to normal homeowner activities. Several homes, however, had chloride levels greater that the benchmark level (26 ppm) nearly every week. These results support the hypothesis that high indoor chloride levels are more likely caused by on going homeowner activities than by a rare chloride producing event. The mean chloride level found in outdoor air condensate samples was five to eight times lower than the mean of the indoor data. The chloride level corresponding to the 99.5 percentile for the outdoor samples could not be estimated because of the limited amount of outdoor data. GRA

N86-27357# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
HISTORICAL DEVELOPMENT OF SOLAR ARRAY DRIVE MECHANISMS BY BRITISH AEROSPACE
I. D. Henderson *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 19-24 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27362# Technische Univ., Munich (West Germany).
TRAJECTORY PLANNING FOR MANIPULATOR SYSTEMS
F. Pfeiffer *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 53-58 (For primary document see N86-27353 18-18)
(Contract SV-I/61-288)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27363# Technische Univ., Munich (West Germany). Lehrstuhl B fuer Mechanik.
MODELING AND CONTROL OF A LIGHTWEIGHT ROBOT
B. Gebler *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 59-64 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27367# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
THERMAL CUTTING HOLDDOWN AND RELEASE MECHANISM
G. J. A. N. Kester *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 89-93 (For primary document see N86-27353 18-18)

Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27370# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
SEMI-ACTIVE MAGNETIC BEARINGS FOR SPACE APPLICATIONS
M. Gauthier and C. Rouyer *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 115-120 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27375# Centre National d'Etudes Spatiales, Toulouse (France).
DEFINITION AND TESTING OF GEARS FOR SPACE ROBOTICS
L. Petitjean and A. Borrien *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 149-154 In FRENCH; ENGLISH summary (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27378# European Space Tribology Lab., Risley (England).
SURFACE-TREATED TITANIUM ALLOY GEARS FOR SPACE MECHANISMS
R. A. Rowntree *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 167-171 Sponsored by ESTEC (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27381# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
A COARSE POINTING MECHANISM FOR AN INTERSATELLITE LASER LINK (ISL2) SYSTEM
R. Kern and K. Kierschke *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 187-192 (For primary document see N86-27353 18-18)
(ESA-86-96851; ESA-SP-231) Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27382# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
DEVELOPMENT AND TESTING OF A DUAL-WOUND dc MOTOR GEARHEAD
B. W. Henson and J. C. Anderson (European Space Tribology Lab., Risley (England).) *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 193-200 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27386# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
EXPERIMENT MANIPULATORS FOR AUTOMATIC SAMPLE HANDLING
N. Cable *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 221-226 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27387# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
A DORNIER LATCH DESIGN FOR A DOCKING MECHANISM
K. Priesett, F. Gampe, R. H. Bentall, and N. Cable *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 227-232 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27388# Sener, S.A., Madrid (Spain).
A SENER LATCH DESIGN FOR DOCKING MECHANISMS
F. Abarrategui, M. Fuentes, J. Rivacoba, and J. A. Ros *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 233-238 (For primary document see N86-27353 18-18)
(Contract ESA-5195/82-NL-BI)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27394# Centre National d'Etudes Spatiales, Toulouse (France).
MECHANISMS DEVELOPED IN THE FRENCH SPACE INDUSTRY
R. Salome and L. Petitjean *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 283-288 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27397# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
SPACE MECHANISMS DEVELOPMENT IN THE ESA TECHNOLOGICAL RESEARCH PROGRAM
D. Wyn-Roberts *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 305-310 (For primary document see N86-27353 18-18)
Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

N86-27470# Weir Pumps Ltd., Glasgow (Scotland).
ROTOR INSTABILITY IN CENTRIFUGAL PUMPS Monthly Report
D. France *In* Shock and Vibration Information Center The Shock and Vibration Digest, Volume 18, No. 1 Jan. 1986 p 3-6 (For primary document see N86-27468 18-31)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N86-27665*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ULTRASONIC STRESS WAVE CHARACTERIZATION OF COMPOSITE MATERIALS Final Report
John C. Duke, Jr., Edmung G. Henneke, II, and Wayne W. Stinchcomb Washington NASA May 1986 161 p
(Grant NAG3-323)
(NASA-CR-3976; E-2948; NAS 1.26:3976) Avail: NTIS HC A08/MF A01 CSCL 14D

The work reported covers three simultaneous projects. The first project was concerned with: (1) establishing the sensitivity of the acousto-ultrasonic method for evaluating subtle forms of damage development in cyclically loaded composite materials, (2) establishing the ability of the acousto-ultrasonic method for detecting initial material imperfections that lead to localized damage growth and final specimen failure, and (3) characteristics of the NBS/Proctor sensor/receiver for acousto-ultrasonic evaluation of laminated composite materials. The second project was concerned with examining the nature of the wave propagation that occurs during acoustic-ultrasonic evaluation of composite laminates and demonstrating the role of Lamb or plate wave modes and their utilization for characterizing composite laminates. The third project was concerned with the replacement of contact-type receiving piezotransducers with noncontacting laser-optical sensors for acousto-ultrasonic signal acquisition. Author

N86-27666*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
WAVE PROPAGATION IN ANISOTROPIC MEDIUM DUE TO AN OSCILLATORY POINT SOURCE WITH APPLICATION TO UNIDIRECTIONAL COMPOSITES Final Report
James H. Williams, Jr., Elizabeth R. C. Marques, and Samson S. Lee Washington NASA Jul. 1986 59 p
(Grant NAG3-328)
(NASA-CR-4001; E-3093; NAS 1.26:4001) Avail: NTIS HC A04/MF A01 CSCL 14D

The far-field displacements in an infinite transversely isotropic elastic medium subjected to an oscillatory concentrated force are derived. The concepts of velocity surface, slowness surface and wave surface are used to describe the geometry of the wave propagation process. It is shown that the decay of the wave amplitudes depends not only on the distance from the source (as in isotropic media) but also depends on the direction of the point of interest from the source. As an example, the displacement field is computed for a laboratory fabricated unidirectional fiberglass epoxy composite. The solution for the displacements is expressed as an amplitude distribution and is presented in polar diagrams. This analysis has potential usefulness in the acoustic emission (AE) and ultrasonic nondestructive evaluation of composite materials. For example, the transient localized disturbances which are generally associated with AE sources can be modeled via this analysis. In which case, knowledge of the displacement field which arrives at a receiving transducer allows inferences regarding the strength and orientation of the source, and consequently perhaps the degree of damage within the composite. Author

N86-27667# Martin Marietta Aerospace, Orlando, Fla.
IMPACT OF HARDWARE/SOFTWARE FAULTS ON SYSTEM RELIABILITY. VOLUME 1. STUDY RESULTS Final Technical Report, Mar. 1983 - Jan. 1985
Edward C. Soistman and Katherine B. Ragsdale Dec. 1985 195 p
(Contract F30602-83-C-0050)
(AD-A165231; OR-18173-Vol-1; RADC-TR-85-228-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 09/2

The objective of this study was to develop techniques for predicting total system reliability, which include the combined effects of software and hardware. Since hardware reliability techniques are much further developed, the study emphasized methods of characterizing software reliability. The software reliability prediction methodology contained in the report is compatible with hardware reliability techniques and definitions and is applicable during early development so that the predictions can influence the design and development process. The software reliability prediction techniques use both software product and development process characteristics to develop estimates of the reliability of the various software components which comprise the system. The software component reliabilities are combined via a Markov model to obtain estimates of software system reliability. Estimates of the execution frequencies of the various software components, as a function of the mission profile, are required by the methodology. Procedures for application of the techniques are provided and are intended for use by a reliability engineer having a basic knowledge of software engineering practices. The techniques offer a rudimentary framework for predicting total system reliability. Validation and refinement of the techniques using software development and field reliability performance data remains to be accomplished.
Author (GRA)

N86-27668# Martin Marietta Aerospace, Orlando, Fla.
IMPACT OF HARDWARE/SOFTWARE FAULTS ON SYSTEM RELIABILITY. VOLUME 2. PROCEDURES FOR USE OF METHODOLOGY Final Technical Report, Mar. 1983 - Jan. 1985
Edward C. Soistman and Katherine B. Ragsdale Dec. 1985 93 p
(Contract F30602-83-C-0050)
(AD-A165232; OR-18173-1-Vol-2; RADC-TR-85-228-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 09/2

The objective of this study was to develop techniques for predicting total system reliability, which include the combined effects of software and hardware. Since hardware reliability techniques are much further developed, the study emphasized methods of characterizing software reliability. The software reliability prediction methodology contained in the report is compatible with hardware reliability techniques and definitions and is applicable during early development so that the predictions can influence the design and development process. The software reliability prediction techniques use both software product and development process characteristics to develop estimates of the reliability of the various software components which comprise the system. The software component reliabilities are combined via a Markov model to obtain estimates of software system reliability. Estimates of the execution frequencies of the various software components, as a function of the mission profile, are required by the methodology. Procedures for application of the techniques are provided and are intended for use by a reliability engineer having a basic knowledge of software engineering practice. The techniques offer a rudimentary framework for predicting total system reliability. Validation and refinement of the techniques using software development and field reliability performance data remains to be accomplished.
Author (GRA)

N86-27669# University of Southern California, Los Angeles.
COGNITIVE WORKLOAD IN FAULT DIAGNOSIS Interim Report, Sep. 1983 - Dec. 1985
Douglas M. Towne Dec. 1985 65 p
(Contract N00014-80-C-0493)
(AD-A165263; TR-107) Avail: NTIS HC A04/MF A01 CSCL 05/10

Prior research has produced a capability to project with reasonable accuracy the manual activities required to accomplish diagnosis and repair of particular faults within a specified system. When applied to a substantial sample of faults, the technique, termed PROFILE, provides an assessment of the manual workload expected to maintain the system. Obtaining usable projections of total repair times, however, requires the estimation of the cognitive portion of fault diagnosis time as well. It is necessary to explore the variations in cognitive times in relation to those characteristics of the diagnostic situation which can be quantified. Three such characteristics are analyzed in detail: (1) the number of tests required to isolate a fault, (2) the total manual time expended in fault diagnosis, and (3) the times of the individual tests in a diagnostic sequence. The most reliable predictor of actual cognitive time for a particular fault was obtained by computing an estimated cognitive time prior to each test based upon the manual time required to perform that test. Since the PROFILE troubleshooting model produces good projections of the particular tests performed to accomplish diagnosis and repair, and their time durations, it can now also compute the estimated cognitive time preceding each test. The sum of the projected cognitive and manual times correspond well with the experimentally observed total diagnosis and repair times. GRA

N86-27670# Hernandez Engineering, Inc., Houston, Tex. Inst. of Sound and Vibration Research.
ESA SAFETY OPTIMIZATION STUDY
James Wiggins, comp., W. vanLeeuwen, comp., F. Teule, G. Hameetman, C. Slippens, R. Ely, and J. Gourlay Paris ESA 1 Aug. 1985 398 p In FRENCH; ENGLISH summary
(Contract ESTEC-6233/85-NL-AB)
(HEI-685/1026; ESA-CR(P)-2140; ESA-86-96869) Avail: NTIS HC A17/MF A01

To help determine the optimum system safety effort, space programs and projects for NASA, DOD, and commercial groups were reviewed to determine what efforts were performed and why these efforts were accomplished. Projects included the Space Shuttle, Inertial Upper Stage, Payload Assist Module, deployable fixed payloads of the Shuttle, and Expendable Launch Vehicle Payloads. Based upon the review and the assessment of the results, recommendations for ESA implementation are included.
ESA

N86-27671# Battelle Columbus Labs., Ohio.
QUALITY ASSURANCE OF HEAT-FUSED POLYETHYLENE PLASTIC PIPE JOINTS, PHASE 3 Final Report, Nov. 1983 - Jan. 1986
L. J. House, J. F. Mank, T. A. Pettenski, and W. J. Williams Jan. 1986 376 p
(Contract GRI-5083-271-0921)
(PB86-174414; GRI-85/0284) Avail: NTIS HC A17/MF A01 CSCL 13B

A prototype of an automated ultrasonic inspection system was developed for field testing of butt fusion joints in polyethylene gas distribution pipe. The inspection system accommodates a range of pipe sizes and a variety of pipe materials. The ultrasonic technique implemented by the inspection devices was demonstrated to detect all known types of flaws that can occur in heat fused pipe joints. The acceptability of the pipe joint is determined by a data processing method developed specifically for the application to account for different pipe sizes, different pipe materials, and the proximity of the flaws to the inner and outer surfaces of the pipe. The inspection system design and the ultrasonic method implemented to detect flaws in polyethylene butt fusion joints are described. GRA

N86-27472# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
COMPUTER-AUTOMATED FAILURE PREDICTION IN MECHANICAL SYSTEMS UNDER DYNAMIC LOADING Monthly Report
C. W. deSilva *In* Shock and Vibration Information Center(Defense), The Shock and Vibration Digest, Volume 17, No. 8, Aug. 1985 p 3-12 (For primary document see N86-27471 18-31)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N86-27672 Engineering Sciences Data Unit, London (England).
STRESS CONCENTRATIONS: INTERACTION AND DECAY FOR SELECTED CASES
Dec. 1985 20 p
(ESDU-85045; ISBN-0-85679-551-8; ISSN-0141-4089; ISSN-0141-3996) Avail: ESDU

Data item ESDU 85045, Stress and Strength Sub-Series, discusses the decay of stress from stress concentration and explains how knowledge of the decay from an individual stress raiser can be used to determine the likely interaction between two similar features. Data are presented on the decay of stress from an elliptical hole in a flat plate loaded either uniaxially or biaxially. Stress concentration factors are also presented for a pair of equal circular holes in a finite width plate loaded uniaxially transverse to the axis of the holes; the data relate to points on the edges of the holes on either end of the diameters transverse to the load. Stress concentration factors are also given for a series of notches in the edge of a plate parallel to the notched edge. ESDU

N86-27673 Engineering Sciences Data Unit, London (England).
CRACK RESISTANCE CURVES
Dec. 1985 46 p Supersedes ESDU-FAT-R.06.01
(ESDU-85031; ISBN-0-85679-537-2; ISSN-0141-3996; ESDU-Fat-R.06.01) Avail: ESDU

Data item ESDU 85031, Fatigue-Fracture Mechanics Sub-Series, provides R-curves for several aerospace sheet materials in SI (International System of Units) and English (lbf, in) units on transparencies for overlaying on plots of stress intensity factor against crack length appropriate to the user's structure (matching blank grids are provided to draw those curves). The co-ordinates of the curves in both sets of units are also tabulated for storing in a computer data base. The curves are indexed by alloy specification, details of which are given together with relevant test conditions. The use of the data is explained, together with the advantages and limitations of the presentation, and two fully worked practical examples illustrate their use to determine the onset of fast fracture. As new data becomes available, they are revised and added to this first issue of ESDU 85031; the first issue date given here does not, therefore, reflect the age of the data or the date of latest revision. ESDU

N86-27674 GKSS-Forschungszentrum Geesthacht (West Germany).
MEASUREMENT OF STABLE CRACK GROWTH INCLUDING DETECTION OF INITIATION OF GROWTH USING THE dc POTENTIAL DROP AND THE PARTIAL UNLOADING METHODS
Karl Heinz Schwalbe, Dieter Hellmann, Juergen Heerens, Juergen Knaack, and Jens Mueller-Roos 1985 30 p Repr. from American Society for Testing and Materials Special Technical Testing Publication 856, 1985 p 338-362
(GKSS-85/E/44; ISSN-0344-9629; ESA-86-96899) Copyright. Avail: Issuing Activity

The ability of the dc potential drop method and the partial unloading technique to measure crack growth and to detect initiation of crack growth was investigated using steels and aluminum alloys. It is found that within the range of parameters investigated, both of the methods can be recommended for the determination of the R curve; however, at small amounts of crack growth, the dc potential drop method gives more consistent results. The initiation values of J integral determined by fractography were compared with Jic as obtained by current practice. It is found that ductile fracture toughness Jic is poorly related to initiation or to a specific amount of crack growth. A modification of the Jic procedure is proposed. Two contacting arrangements of the dc potential drop method were checked for initiation detection: one indicates initiation by a potential minimum (related to a J value Jmin), the other by the intersection of the R curve with the blunting line (related to a J value Jint). ESA

N86-27675 GKSS-Forschungszentrum Geesthacht (West Germany).
SUGGESTIONS FOR A MODIFICATION OF ASTM E 813
Karl-Heinz Schwalbe and Juergen Heerens 1985 10 p Repr. from American Society for Testing and Materials Special Technical Testing Publication 856, 1985 p 411-416
(GKSS-85/E/45; ISSN-0344-9629; ESA-86-96900) Copyright. Avail: Issuing Activity

Modifications of the present procedure for the determination of fracture toughness (Jic) are proposed to ensure better consistency of data. A blunting line which takes advantage of theoretical work concerning the crack-tip behavior and which shows good agreement with fractographical data is proposed. The Jic value is that point on the initial part of the R curve that is determined by the intersection of the R curve with an intercept line parallel to and by an amount delta a off the blunting line. ESA

N86-27676 United Kingdom Atomic Energy Authority, Risley (England).
DETERMINATION OF CRACK ARREST CHARACTERISTICS BY MEANS OF ROTATING DISCS
E. Roos and H. Griesinger 5 Jun. 1986 22 p Transl. into ENGLISH of conference paper "Rissstopuntersuchungen an Rotierenden Scheiben" presented at the 11th MPA Seminar, 1985 Conference held in Stuttgart, West Germany, 10-11 Oct. 1985
(BLL-Risley-Tr-5281-(9091.9F)) Copyright. Avail: NTIS HC A02/MF A01

A complete analytical description of the behavior of pressure vessels would contain information on whether a vessel fails by leaking or by large-scale fracture. To decide this one needs to know various material parameters which describe the crack initiation and crack arrest behavior of cracked vessels. Experimental and

theoretical examinations have shown that crack initiation values determined statically on laboratory specimens are directly applicable to vessels. With the usual test specimens and test methods this has not been the case, however, for the crack arrest parameters. This report describes a method with which it should be possible to determine crack arrest parameters applicable to pressure vessels. Author

N86-27677 Stanford Univ., Calif.
THERMAL AND ELECTROMAGNETIC DAMPING ANALYSIS AND ITS APPLICATION Ph.D. Thesis
Lee Usik 1985 308 p
Avail: Univ. Microfilms Order No. DA8511326

Passive damping techniques, as a part of vibration control, have been researched extensively during the past decade to gain successful performance of vibrating systems by reducing undesirable vibrations. Most of the research has been focussed on artificially furnished damping which is relatively larger than material damping. Large space structures require light-weight construction with extremely accurate positioning requirements. Even a tiny amount of material damping has been recognized as essential for meeting such requirements of large space structures such as telescopes and attennas in space. The purpose of this research is to estimate analytically the thermal damping due to thermal currents and the electromagnetic damping due to electric conduction currents based on coupled thermoelasticity and coupled magnetoelasticity. Also, the influence of thermal damping on the aeroelastic stabilities is investigated based on the theory of two-dimensional aerodynamics. In this research the study of effects of structural and geometrical constraints on damping loss factors are investigated. Optimum conditions for the maximum damping, which may be useful on the stage of system design, are investigated. Dissert. Abstr.

N86-27678# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
STATIC AEROELASTICITY IN COMBAT AIRCRAFT
Jan. 1986 42 p
(AGARD-R-725; ISBN-92-835-1516-1) Avail: NTIS HC A03/MF A01

A review of fighter aircraft development programs over the past three decades indicates a trend of increasing emphasis on the consideration of static aeroelastic effects. While early concerns addressed only the impact on air vehicle structural integrity, current design philosophy recognizes and addresses aeroelasticity as a primary design parameter affecting structural optimization, vehicle aerodynamic stability, control effectiveness, and overall performance. Examples from wind tunnel testing, analytical studies, and operational applications are presented to justify this emphasis, illustrate current methodology and analysis techniques, and make a case for an integrated approach to the consideration of static aeroelastic effects at all stages of the design process. Author

N86-27679# National Aerospace Lab., Tokyo (Japan).
AXISYMMETRIC AND BEAM-LIKE BENDING DEFORMATIONS IN THIN ELASTIC CIRCULAR CYLINDRICAL SHELLS DUE TO THERMAL LOADS
Shuji Endo Nov. 1985 44 p In JAPANESE; ENGLISH summary
(NAL-TR-891; ISSN-0389-4010) Avail: NTIS HC A03/MF A01

The problems of axisymmetric and beam-like bending deformations in a thin circular cylindrical shell due to thermal loads are analyzed utilizing the Fluegge, the Naghdi, the Koiter-Sanders, the Novozhilov, and the Love-Reissner theories for the case where both edges of the shell are simply supported. The first approximate expressions based on the Kirchoff-Love hypothesis are obtained in closed form for the displacements, stress resultants, and stress couples. It is then shown that the various theories provide the same results within engineering accuracy except when the shell is extremely long. Also, for the case when the temperature rise is uniform in the axial direction, the extremum values of stress resultant and couples occurring in the edge-zone are calculated. From the calculations, it is shown that, except for a very short shell, the extrema are independent of the length of the cylindrical shell. Author

N86-27680*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RE-EXAMINATION OF CUMULATIVE FATIGUE DAMAGE ANALYSIS: AN ENGINEERING PERSPECTIVE
S. S. Manson and G. R. Halford 1986 71 p Presented at the Symposium on Mechanics of Damage and Fatigue, Haifa-Tel Aviv, Israel, 1-5 Jul. 1985; sponsored by the International Union of Theoretical and Applied Mechanics
(NASA-TM-87325; E-3066; NAS 1.15:87325) Avail: NTIS HC A04/MF A01 CSCL 20K

A method which has evolved in our laboratories for the past 20 yr is re-examined with the intent of improving its accuracy and simplicity of application to engineering problems. Several modifications are introduced both to the analytical formulation of the Damage Curve Approach, and to the procedure for modifying this approach to achieve a Double Linear Damage Rule formulation which immensely simplifies the calculation. Improvements are also introduced in the treatment of mean stress for determining fatigue life of the individual events that enter into a complex loading history. While the procedure is completely consistent with the results of numerous two level tests that have been conducted on many materials, it is still necessary to verify applicability to complex loading histories. Caution is expressed that certain phenomena can also influence the applicability - for example, unusual deformation and fracture modes inherent in complex loading - especially if stresses are multiaxial. Residual stresses at crack tips, and metallurgical factors are also important in creating departures from the cumulative damage theories; examples of departures are provided. Author

N86-27681# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
DYNAMICS OF VISCOELASTIC STRUCTURES
Kerman Jamshed Buhariwala Jun. 1986 208 p Sponsored by the National Sciences and Engineering Research Council of Canada
(UTIAS-309; ISSN-0082-5255) Avail: NTIS HC A10/MF A01

A general method for modelling energy dissipation in dynamical systems is presented. The work is primarily concerned with a damping model based on viscoelastic assumptions motivated by the concern for analyzing structures composed of fiber reinforced polymeric composite materials. A brief review of linear viscoelasticity is presented. Motion equations are formulated in operator form for an aribrary viscoelastic structure of generation anisotropy. The mass, damping, and stiffness operators are developed consistently in the formation. Basic operator properties are discussed and orthonormality conditions are derived for the viscoelastic system. Modal identities are derived for a constrained viscoelastic structure. These identities are a helpful guide in checking the accuracy of the numerical solution. The modal identities of viscoelastic systems are shown to reduce to those of the elastic systems for light damping. An extension to the classical lamination theory based on viscoelastic constitutive equations is presented. The motion equations of a viscoelastic laminate are shown to be of the same form as the motion equations of the classical elastic laminate plate. The inplane membrane, coupling, and bending stiffness coefficients for the viscoelastic plate problem are time dependent operators. Next the consistent, discretized motion equations are developed using the finite element method. The equations of motion are integro-differential and so, the resulting eigenproblem cannot be handled by standard numerical routines. The eigenvalues and eigenmodes are solved by Jacobi root perturbation method. Eigenvalues and eigenmodes using Jacobi root perturbation method are calculated for a cantilevered viscoelastic beam. Author

N86-27682# National Aeronautical Lab., Bangalore (India). Structures Div.
STRESS OSCILLATIONS IN PLANE STRESS MODELLING OF FLEXURE: A FIELD-CONSISTENCY INTERPRETATION

G. Prathap, G. Subramanian, and C. Ramesh Babu Jun. 1985 35 p
(TM-ST-8507) Avail: NTIS HC 03/MF A01

Exactly integrated isoparametric plane stress elements behave poorly in flexure. The 4-noded element locks, with errors that progress indefinitely as the element aspect ratio increases. Reduced integration of the shear strain energy eliminates this locking entirely. The 8-noded element does not lock, but improves in performance with reduced integration of shear strain energy. Both elements, with their original shape functions show severe shear stress oscillations in flexure. These oscillations are attributed to the lack of consistency of shear strain fields derived directly from independent field-variable interpolations. Error models were derived for specific tractable examples which can confirm the accuracy of this conceptual scheme through digital computation using the finite element models. A field-consistent redistribution strategy for the shear strain-field is offered as an elegant procedure to free the elements of spurious oscillations and give a lock free performance. Author

N86-27683# National Aeronautical Lab., Bangalore (India).
ON THE FICTION OF THE KIRCHHOFF EFFECTIVE SHEAR REACTIONS
G. Prathap and C. Ramesh Babu Jan. 1986 29 p
(NAL-TM-ST-8601) Avail: NTIS HC A03/MF A01

The development of accurate and reliable plate bending elements based on the shear flexible Mindlin plate theory has resulted in attempts to accurately evaluate bending moments and shear forces in transversely loaded plates. It appears from such studies that the interpretation of the classical Kirchhoff-Love theory in terms of only two boundary conditions at an edge and the related merging of the actual shear force and twisting moments on an edge into an effective Kirchhoff shear reaction is ambiguous in physical terms and must be revised. An improved interpretation is offered that brings Kirchhoff theory into line with Mindlin theory, and leads to the conclusion that the use of three boundary conditions on an edge as offered by Poisson is correct from the physical point of view, especially for unsupported edges, and that there is no need to define a Kirchhoff effective shear reaction at all. Author

N86-27684# National Aeronautical Lab., Bangalore (India). Materials Science Div.
RESEARCH AND DEVELOPMENT IN THE FIELD OF FATIGUE AND FRACTURE MECHANICS AT NAL
Kn Raju and R. Sunder Dec. 1985 64 p
(NAL-SR-8501) Avail: NTIS HC A04/MF A01

Research and development in the area of fatigue and fracture mechanics at the National Aeronautical Laboratory is described, highlighting some of the interesting and useful results obtained. The beginning of research and development activities at NAL dates back to the late sixties. Thus, what is related in this paper covers work over a period of more than a decade. Author

N86-27685# National Aeronautical Lab., Bangalore (India). Materials Science Div.
CLOSURE OF PART THROUGH CRACKS AT THE NOTCH ROOT
K. Anandan and R. Sunder Apr. 1986 54 p
(NAL-PD-MT-8625) Avail: NTIS HC A04/MF A01

A study of fatigue closure of part through cracks in notched 5mm thick Al-Cu alloy sheet specimens is described. The study used a specially designed electron fractography technique which permits accurate assessment of closure, its development with crack extension as well as its variation across the crack front. The effect of prior overloads on notch root crack closure was also investigated. Author

N86-27686# Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 17, NO. 6 Monthly Report
Judith Nagle-Eshleman, ed. Jun. 1985 97 p
(AD-A165500) Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Topics addressed include mechanical systems, structural systems, vehicle systems, biological systems, mechanical components, structural components, electric components, dynamic environment, analysis and design, mechanical properties, and experimentation. A literature review on flexural rigidity of stranded cables is provided. Frequency domain modal analysis techniques are also reviewed. For individual titles, see N86-27687 through N86-27688.

N86-27687# Polytechnic Inst. of Bucharest (Rumania).
FREQUENCY DOMAIN EXPERIMENTAL MODAL ANALYSIS TECHNIQUES Monthly Report
M. Rades *In* Shock and Vibration Information Center The Shock and Vibration Digest, Volume 17, No. 6 Jun. 1985 p 3-16 (For primary document see N86-27686 18-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Recent advances in the development of structural modal identification procedures are reviewed. Only methods concerned with frequency response data in the frequency domain are considered. Emphasis is on the theoretical background of analytical modal characterization techniques. Testing philosophy is also considered. Author

N86-27688# Central Power Research Inst., Bangalore (India).
FLEXURAL RIGIDITY OF STRANDED CABLES Monthly Report
T. V. Gopalan and G. R. Nagabhushana (Indian Inst. of Science, Bangalore) *In* Shock and Vibration Information Center The Shock and Vibration Digest, Volume 17, No. 6 Jun. 1985 p 17-20 (For primary document see N86-27686 18-39)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

Flexural rigidity and maximum fiber distance are important in the dynamics of the multi-stranded cables used in overhead power lines. A satisfactory solution based on experimental results for obtaining these parameters is discussed. Author

N86-27689*# Argonne National Lab., Ill.
EFFECTS OF A HIGH MEAN STRESS ON THE HIGH CYCLE FATIGUE LIFE OF PWA 1480 AND CORRELATION OF DATA BY LINEAR ELASTIC FRACTURE MECHANICS
S. Majumdar and R. Kwasny Nov. 1985 28 p
(NASA Order C-91113-D; Contract W-31-109-eng-38)
(NASA-CR-175057; NAS 1.26:175057; ANL-85-74) Avail: NTIS HC A03/MF A01 CSCL 20K

High-cycle fatigue tests using 5-mm-diameter smooth specimens were performed on the single crystal alloy PWA 1480 (001 axis) at 70F (room temperature) in air and at 100F (538C) in vacuum (10 to the -6 power torr). Tests were conducted at zero mean stress as well as at high tensile mean stress. The results indicate that, although a tensile mean stress, in general, reduces life, the reduction in fatigue strength, for a given mean stress at a life of one million cycles, is much less than what is predicted by the usual linear Goodman plot. Further, the material appears to be significantly more resistant to mean stress effects at 1000F than at 70F. Metallographic examinations of failed specimens indicate that failures in all cases are initiated from micropores of sizes of the order of 30 to 40 microns. Since the macroscopic stress-strain response in all cases was observed to be linear elastic, linear elastic fracture mechanics (LEFM) analyses were carried out to determine the crack growth curves of the material assuming that crack initiation from a micropore (a sub o = 40 microns) occurs very early in life. The results indicate that the calculated crack growth rates at an R (defined as the ratio between minimum stress to maximum stress) value of zero are approximately the same at 70F as at 1000F. However, the calculated crack growth rates at other R ratios, both positive and negative, tend to be higher at 70F than at 1000F. Calculated threshold effects at large R values tend to be independent of temperature in the temperature regime studied. They are relatively constant with increasing R ratio

up to a value of about 0.6, beyond which the calculated threshold stress intensity factor range decreases rapidly with increasing R ratios. Author

N86-27690# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
NONLINEAR ELASTIC AND INELASTIC ANALYSIS OF STRUCTURAL MEMBERS IN THE PRESENCE OF HIGH TEMPERATURE AND CREEP Final Report, 10 Jan. 1984 - 30 Sep. 1985
Walter D. Pilkey 20 Dec. 1985 12 p
(Contract N00014-83-K-0392)
(AD-A165140; UVA/5-25387/MAE86/101) Avail: NTIS HC A02/MF A01 CSCL 20/11

This research began with a mixed principle based creep analysis and was later redirected to a study of limiting performance methodology, including a formulation for the limiting performance analysis of large systems. The formulations for dynamic systems apply to problems for which such variables as maximum displacements or stresses, relative displacements, peak velocities or accelerations are of concern. GRA

N86-27691# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NATURAL FREQUENCIES AND MODE SHAPES OF CURVED RECTANGULAR COMPOSITE PANELS WITH INTERIOR CUTOUTS M.S. Thesis
Richard A. Walley Dec. 1985 101 p
(AD-A165269; AFIT/GAE/AA/85D-16) Avail: NTIS HC A06/MF A01 CSCL 13/13

A finite element computer code, STAGSC-1 and holographic interferometry were used to determine the effects of interior cutouts on the first five natural frequencies and mode shapes of curved Graphite Expoxy panels. The panels are a quasi-isotropic layup with a 12 inch chord and height. Both the finite element and holographic analysis were conducted using clamped-clamped boundary conditions. The vibration branch of STAGSC-1 is an energy technique based on small displacements and linear elastic stress-strain relationships. When compared with the time averaged holograms of the experimentally determined natural frequencies and mode shapes, the two techniques show a close correlation of both frequency and shape. It was found that for the 2 x 2 inch cutout, the mode shapes change very little while the natural frequencies displayed a small decrease for the higher modes. The 2 x 4 inch cutout retained the general mode shape of the solid panel for the first two modes. The third through the fifth mode shapes were changed by this cutout and the loss of panel stiffness was visible. The 4 x 4 inch cutout exhibit both a switch in symmetry of the first two modes and a general decrease in natural frequencies. GRA

N86-27692# Brookhaven National Lab., Upton, N. Y.
MODELING EFFECTS OF THIN FILM FORMATION AT CRACK TIPS ON FRACTURE
K. Sieradzki 15 Apr. 1986 18 p Presented at the TMS/AIME Fall Meeting, Toronto, Ontario, 13 Oct. 1985
(Contract DE-AC02-76CH-00016)
(DE86-001180; BNL-37094; CONF-8510168-1) Avail: NTIS HC A02/MF A01

This paper discusses the manner in which thin films surrounding cracks can induce deformational mode transitions in materials; that is, cracks which normally deform by dislocation emission can be made to cleave (and vice versa) by coating the crack surfaces with films of appropriate properties. Such films actually form on metallic crack surfaces in certain environments and lead to the phenomenon known as stress-corrosion cracking. Analytical calculations are presented and the results indicate that the important parameters influencing deformational mode transitions include elastic modulus, film-substrate lattice parameter mismatch, film thickness, and interfacial bond strength. DOE

N86-27693# Materials Engineering Associates, Inc., Lanham, Md.
A REVIEW OF THE MODELS AND MECHANISMS FOR ENVIRONMENTALLY-ASSISTED CRACK GROWTH OF PRESSURE VESSEL AND PIPING STEELS IN PWR ENVIRONMENTS
W. Cullen, G. Gabetta (Centro Informazioni Studi Esperienze, Milan Italy), and H. Hanninen (Technical Research Centre of Finland, Espoo) Dec. 1985 115 p
(TI86-900460; NUREG-CR-4422) Avail: NTIS HC A06/MF A01

The crack-tip micromechanisms and the computational models for environmentally-assisted cracking in pressure vessel and piping steels in high-temperature, low-oxygen (PWR), reactor-grade water are described and evaluated. The report begins with a brief description of the critical variables which are known to affect environmentally-assisted subcritical cracking in these metal/environment systems. The micromechanistic models are discussed in some detail, with anodic dissolution and hydrogen assistance being the prime candidates for the successful explanation of the observed phenomena. A variety of calculational models are in various stages of development; all of them are far from use as a predictive tool. Crack-tip strain rate models have received the most attention, and the approach to their use has been to partition the environmentally-assisted growth rates into a mechanically-driven component, with the environmental enhancement superposed. The environment component is then correlated with a calculated crack-tip strain rate. At the present time, these models predict monotonically increasing growth rates with increases in the cyclic period, which is incorrect, although for cases in which the environment assistance is significant, the strain rate models, with a suitable choice of fitting parameters, correlate with the data reasonably well. Author

42 GEOSCIENCES (GENERAL)

N86-27694# Meteorological Satellite Center, Tokyo (Japan).
METEOROLOGICAL SATELLITE CENTER TECHNICAL NOTE, NO. 13, 1986
Mar. 1986 73 p In ENGLISH and JAPANESE
(ISSN-0388-9653) Avail: NTIS HC A04/MF A01

Two articles are presented, one addressing the land-sea contrast in the Earth radiation budget and the other discussing the Cb cloud vortical pattern apart from a typhoon pressure center. In addition, a bibliography of references dealing with the use of satellite data in practical work and research is given. For individual titles, see N86-27695 through N86-27696.

N86-27695# Meteorological Satellite Center, Tokyo (Japan).
ON LAND-SEA CONTRAST IN THE EARTH RADIATION BUDGET **c46**
Isao Kubota and Hiroko Imai *In its* Meteorological Satellite Center Technical Note, no. 13, 1986 (ISSN-0388-9653) Mar. 1986 p 1-31 In JAPANESE; ENGLISH summary (For primary document see N86-27694 18-42)
Avail: NTIS HC A04/MF A01

In order to make clear the difference between the Earth's radiation budget over land and over sea, three components of the budget; absorbed solar radiation, emitted terrestrial radiation, and net total radiation N on the Earth-atmosphere system measured by the wide field of view sensor aboard NIMBUS 7 were analyzed for the period during November 1978 to October 1979. The resultant zonal averages over each land and sea showed following facts. Both S and N in the latitudinal range 40 degrees around the solar declination are above 40 W/sq m larger over the sea than over land. The excess of S over sea beyond land stems mainly from differences of both clear-sky albedo and cloud amount between over land and over sea. In the latitudinal range 30 degrees centered 60N or 60S, S over land in summer is above 15 W/sq m greater then over sea contrary to the low latitudes. Finally, examination of latitudinal variation of T all the year round shows that there are a minimum zone near the equator corresponding to ITCZ, and a maximum zone in the subtropical area of each hemisphere corresponding to the subtropical high pressures

or the downward stream branches of the direct circulation. The minimum in the zonal monthly average over land tends to be lower than over sea and the both maximums over land tend to be greater than over sea. These facts show that the direct circulation over land looks more active than over sea. Author

N86-27696# Meteorological Satellite Center, Tokyo (Japan).
ON THE Cb CLOUD VORTICAL PATTERN APART FROM TYPHOON PRESSURE CENTER **c47**
Shuhei Akashi, Hiroyuki Koba, and Michio Hitsuma *In its* Meteorological Satellite Center Technical Note, no. 13, 1986 (ISSN-0388-9653) Mar. 1986 p 33-56 IN JAPANESE; ENGLISH summary (For primary document see N86-27694 18-42)
Avail: NTIS HC A04/MF A01

In several tropical cyclones, it was observed that vortex of cumulonimbus (Cb) cloud located apart from the pressure center of the tropical cyclone in stage of movement into the Westery belt and transformation to an extratropical cyclone. By the study of two cases, typhoon 8506 and 8124, findings are follows: (1) pressure center of the cyclone coincides with the vortex of the low-level cloud rather than with the Cb-vortex; (2) the separation between Cb-vortex has begun 12 to 36 hours before the transformation from a tropical cyclone to an extratropical cyclone; (3) the distance of separation between each vortex increased according to the cyclone's movement and finally has extended to 200 km; (4) Cb-vortex located eastward from the low-level cloud's vortex and the relative position of them rotated counterclockwise with the lapse of time; and (5) the low-level cloud's vortex is not always distinct, and generally, there are little upper cloud in this region. Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N86-27697 GKSS-Forschungszentrum Geesthacht (West Germany).
ON THE INFORMATION CONTENT OF MULTISPECTRAL RADIANCE MEASUREMENTS OVER AN OCEAN
Juergen Fischer 1985 16 p Repr. from International Journal of Remote Sensing, v. 6, no. 5, 1985 p 773-786 In GERMAN
(GKSS-85/E/43; ISSN-0344-9629; ESA-86-96898) Avail: Issuing Activity

An eigenvalue analysis and a multivariate significance test are applied to the problem of measuring suspended matter, phytoplankton, and yellow substance from ship, aircraft, or satellite. The number of linearly independent pieces of information is inferred from multispectral radiance measurements at six wavelengths within the visible part of the spectrum. The radiances analyzed are calculated with a radiative transfer model (matrix operator method) for an atmosphere-ocean system and realistic variations of scattering and absorption by hydrosols in ocean waters, as well as maritime atmospheric aerosols. Instrumental errors and errors in atmospheric correction strongly determine the information content. The wavelength dependence of both errors is taken into account. Depending on atmospheric and oceanic turbidity, at most 2 independent optical parameters of water substances can be derived with an accuracy of a factor of 2 from multispectral radiance measurements made at a height of 10 km. ESA

N86-27698*# Maryland Univ., College Park. Office of Sponsored Programs.
DEPARTMENT OF GEOLOGY/NASA-GSFC GEOBOTANICAL INVESTIGATION Summary Report
26 May 1986 10 p refs
(Grant NsG-5423)
(NASA-CR-177300; NAS 1.26:177300) Avail: NTIS HC A02/MF A01 CSCL 02F

Geobotanical mapping in the southern Appalachians and soil metal associated changes in vegatation spectral responses in the reflective and emissive portions of the electromagnetic spectrum (EMS) is studied. It is determined whether deciduous forest vegetation reflection and emission characteristics show detectable changes that can be related to residual soil characteristics. Analyses of such related characteristics enhances the ability to discriminate underlying lithologies as well as variances within lithologies associated with natural heavy metal occurences. An understanding is developed of the factors which contribute to the differing spectral signatures of various lithology/soil types. A combination of field data and remote spectral analysis is studied. E.R.

N86-27699*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE DETECTION OF PHYTOPLANKTON EXPORT FROM THE MID-ATLANTIC BIGHT DURING THE 1979 SPRING BLOOM
John J. Walsh (University of South Florida, St. Petersburg.), Dwight A. Dieterle, and Wayne E. Esaias Feb. 1986 53 p Sponsored in part by DOE and NOAA
(NASA-TM-88782; NAS 1.15:88782) Avail: NTIS HC A04/MF A01 CSCL 08A

Analysis of Coastal Zone Color Scanner (CZCS) imagery confirms shipboard and in situ moored fluorometer observations of resuspension of near-bottom chlorophyll within surface waters (1 to 10 m) by northwesterly wind events in the mid-Atlantic Bight. As much as 8 to 16 micrograms chl/l are found during these wind events from March to May, with a seasonal increase of algal biomass until onset of stratification of the water column. Rapid sinking or downwelling apparently occurs after subsequent wind events, however, such that the predominant surface chlorophyll pattern is approx. 0.5 to 1.5 micrograms/l over the continental shelf during most of the spring bloom. Perhaps half of the chlorophyll increase observed by satellite during a wind resuspension event represents in-situ production during the 4 to 5 day interval, with the remainder attributed to accumulation of algal biomass previously produced and temporarily stored within near-bottom water. Present calculations suggest that about 10% of the primary production of the spring bloom may be exported as ungrazed phytoplankton carbon from mid-Atlantic shelf waters to those of the continental slope. Author

N86-27700*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
HIGH FREQUENCY SAMPLING OF THE 1984 SPRING BLOOM WITHIN THE MID-ATLANTIC BIGHT: SYNOPTIC SHIPBOARD, AIRCRAFT, AND IN SITU PERSPECTIVES OF THE SEEP-I EXPERIMENT
John J. Walsh (University of South Florida, St. Petersburg), Creighton D. Wirick (Brookhaven National Lab., Upton, N. Y.), Leonard J. Pietrafesa (North Carolina State Univ., Raleigh.), Terry E. Whitledge (Texas Univ., Port Aransas), Frank E. Hoge, and Robert N. Swift (EG and G Washington Analytical Services Center, Inc., Pocomoke City, Md.) 1986 56 p
(NASA-TM-88765; NAS 1.15:88765) Avail: NTIS HC A04/MF A01 CSCL 08A

Moorings of current meters, thermistors, transmissometers, and fluorometers on the mid-Atlantic shelf, south of Long Island, suggest a cumulative seaward export of perhaps 0.35 g C/sq m/day between the 80 and 120 m isobaths during February-April 1984. Such a horizontal loss of algal carbon over the lower third of the water column would be 23 to 78% of the March-April 1984 primary production. This physical carbon loss is similar to daily grazing losses from zooplankton of 32-40% of the algal fixation of carbon. Metabolic demands of the benthos could be met by just the estimated fecal pellet flux, without direct consumption of algal carbon, while bacterioplankton needs could be served by excretory release of dissolved organic matter during photosynthesis. Sediment traps tethered 10 m off the bottom at the 120 m isobath and 50 m above the 500 m isobath caught as much as 0.16 to 0.26 g C /sq m/day during March-April 1984, in

reasonable agreement with the flux estimated from the other moored instruments. Author

N86-27701*# Connecticut Univ., Storrs. School of Engineering.
A SENSTITIVITY STUDY OF THE GROUND HYDROLOGIC MODEL USING DATA GENERATED BY AN ATMOSPHERIC GENERAL CIRCULATION MODEL Ph.D. Thesis
Shu Fen Sun 1985 245 p
(Grant NsG-5075)
(NASA-CR-177285; NAS 1.26:177285) Avail: NTIS HC A11/MF A01 CSCL 08H

The Ground Hydrologic Model (GHM) developed for use in an atmospheric general circulation model (GCM) has been refined. A series of sensitivity studies of the new version of the GHM were conducted for the purpose of understanding the role played by various physical parameters in the GHM. The following refinements have been made: (1) the GHM is coupled directly with the planetary boundary layer (PBL); (2) a bulk vegetation layer is added with a more realistic large-scale parameterization; and (3) the infiltration rate is modified. This version GHM has been tested using input data derived from a GCM simulation run for eight North America regions for 45 days. The results are compared with those of the resident GHM in the GCM. The daily average of grid surface temperatures from both models agree reasonably well in phase and magnitude. However, large difference exists in one or two regions on some days. The daily average evapotranspiration is in general 10 to 30% less than the corresponding value given by the resident GHM. Author

N86-27702*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Geological Sciences.
RELATIONSHIP BETWEEN HIGH- AND LOW-GRADE ARCHEAN TERRANES: IMPLICATIONS FOR EARLY EARTH PALEOGEOGRAPHY Final Technical Report, 1 Mar. 1985 - 31 Aug. 1986
Kenneth A. Eriksson 1986 60 p
(Grant NAG9-95)
(NASA-CR-177202; NAS 1.26:177202) Avail: NTIS HC A04/MF A01 CSCL 08E

The Western Gneiss Terrain (WGT) of the Yilgarn Block, Western Australia was studied. The WGT forms an arcuate belt of Archean gneisses that flank the western margin of the Yilgarn Block. In general the WGT is composed of high-grade orthogneisses and paragneisses which contain supracrustal belts composed largely of siliciclastic metasediments and subordinate iron formation. The platformal nature of the metasedimentary belts and lack of obvious metavolcanic lithologies contrasts with the composition of typical Yilgarn greenstones to the east. Radiometric data from WGT rocks indicates that these rocks are significantly older than Yilgarn rocks to the east (less than 3.3 Ga) and this has led to the suggestion that the WGT represents sialic basement to Yilgarn granite-greenstone belts. The Mount Narryer region exposes the northernmost occurrence of high-grade metasediments within the WGT and consists of quartz-rich clastic metasediments at upper amphibolite to granulite grade. Most occurrences of supracrustal rocks in this region comprise isolated lenses within the gneissic basement. However, at Mount Narryer a unique sequence of metaclastics with preserved bedding provide an unusual window into the parentage of similar supracrustal bodies in this region. M.G.

N86-27703# National Oceanic and Atmospheric Administration, Washington, D. C.
SATELLITE-DERIVED MOISTURE PROFILES
Andrew Timchalk Apr. 1986 70 p
(NOAA-NESDIS-24) Avail: NTIS HC A04/MF A01

An evaluation of relative humidity and mixing ratio profiles determined by two different satellite methods is presented. One method (bogus), which is used operationally, uses GOES cloud imagery to prescribe vertical moisture profiles. The second method (TOVS) uses a 15-channel algorithm with polar orbiting satellite data. The accuracies of both methods, although inferior to moisture profiles obtained from rawinsondes, show sufficient accuracy to be useful as input into forecast models whose domain includes large oceanic areas. TOVS moisture profiles were more accurate in clear and partly cloudy areas, whereas the bogus profiles were more accurate in the broken cloud cover areas. An advantage of the TOVS method is that it is fully automated and can be applied globally; however, some accompanying disadvantages are that the retrievals are asynoptic and that they are made only in clear and partly cloudy areas. The major advantage of the bogus method is that profiles are available at synoptic times and over areas where no TOVS moisture values are retrieved. The disadvantage of the bogus method is that the moisture values are less accurate than the TOVS values in clear and partly cloudy areas. Furthermore, the method is only partially automated and requires subjective interpretation of cloud imagery. Author

N86-27704*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
PRELIMINARY ASSESSMENT OF SOIL MOISTURE OVER VEGETATION Final Report, 1 Mar. 1985 - 28 Feb. 1986
Toby N. Carlson Jul. 1986 40 p
(Grant NAG5-184)
(NASA-CR-177226; NAS 1.26:177226) Avail: NTIS HC A03/MF A01 CSCL 08M

Modeling of surface energy fluxes was combined with in-situ measurement of surface parameters, specifically the surface sensible heat flux and the substrate soil moisture. A vegetation component was incorporated in the atmospheric/substrate model and subsequently showed that fluxes over vegetation can be very much different than those over bare soil for a given surface-air temperature difference. The temperature signatures measured by a satellite or airborne radiometer should be interpreted in conjunction with surface measurements of modeled parameters. Paradoxically, analyses of the large-scale distribution of soil moisture availability shows that there is a very high correlation between antecedent precipitation and inferred surface moisture availability, even when no specific vegetation parameterization is used in the boundary layer model. Preparatory work was begun in streamlining the present boundary layer model, developing better algorithms for relating surface temperatures to substrate moisture, preparing for participation in the French HAPEX experiment, and analyzing aircraft microwave and radiometric surface temperature data for the 1983 French Beauce experiments. B.G.

N86-27705*# Arizona Univ., Tucson. Optical Sciences Center.
SPECTRORADIOMETRIC CONSIDERATIONS FOR ADVANCED LAND OBSERVING SYSTEMS Final Report
Philip N. Slater Jul. 1986 101 p
(Grant NAG5-196)
(NASA-CR-177205; NAS 1.26:177205) Avail: NTIS HC A06/MF A01 CSCL 08B

Research aimed at improving the inflight absolute radiometric calibration of advanced land observing systems was initiated. Emphasis was on the satellite sensor calibration program at White Sands. Topics addressed include: absolute radiometric calibration of advanced remote sensing; atmospheric effects on reflected radiation; inflight radiometric calibration; field radiometric methods for reflectance and atmospheric measurement; and calibration of field relectance radiometers. B.G.

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N86-27706* National Aeronautics and Space Administration. Pasadena Office, Calif.

PROTECTIVE TELESCOPING SHIELD FOR SOLAR CONCENTRATOR Patent
Maurice J. Argoud (Jet Propulsion Lab., California Inst. of Tech., Pasadena), Walter L. Walker, and Lloyd V. Butler, inventors (to NASA) Issued 6 May 1986 7 p Filed 22 Feb. 1984 Supersedes N84-25164 (22 - 15, p 2361) Sponsored by NASA. Pasadena Office
(NASA-Case-NPO-16236-1; US-Patent-4,586,487; US-Patent-Appl-SN-582495; US-Patent-Class-126-418; US-Patent-Class-126-419; US-Patent-Class-126-438) Avail: US Patent and Trademark Office CSCL 10A

An apparatus is described for use with a solar concentrator such as a parabolic dish which concentrates sunlight onto a small opening of a solar receiver, for protecting the receiver in the event of a system failure that could cause concentrated sunlight to damage the receiver. The protective apparatus includes a structure which can be moved to a stowed position where it does not block sunlight, to a deployed position. In this position, the structure forms a tube which substantially completely surrounds an axis connecting the receiver opening to the center of the concentrator at locations between the receiver and the concentrator. NASA

N86-27707# EG and G Washington Analytical Services Center, Inc., Berkeley, Calif.
OTEC (OCEAN THERMAL ENERGY CONVERSION) COLD WATER PIPE AT-SEA TEST PROGRAM DATA ANALYSIS PROJECT. COMPARISONS BETWEEN MEASURED AND PREDICTED BARGE AND PIPE RESPONSE: EVALUATION OF THE NOAA/ROTECF AND NOAA/TRW COMPUTER MODELS
L. A. Vega and G. C. Nihous Oct. 1985 64 p
(Contract DGNC-5-00093)
(PB86-177599) Avail: NTIS HC A04/MF A01 CSCL 10B

The simulation of the at-sea test conditions with computer models is considered. The NOAA/ROTECF model simulates a coupled barge/pipe system driven by waves and currents in the frequency domain (standard-deviation parameters are considered). The NOAA/TRW model simulates a pipe driven by user-specified barge motions, waves, and currents in the time domain (parameters as a function of time are considered). GRA

N86-27708*# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.
MOD-5A WIND TURBINE GENERATOR PROGRAM DESIGN REPORT: VOLUME 1: EXECUTIVE SUMMARY Final Report
Aug. 1984 63 p
(Contracts DEN3-153; DE0AI01-79ET-20305)
(NASA-CR-174734; DOE/NASA-0153/1; NAS 1.26:174734) Avail: NTIS HC A04/MF A01 CSCL 10A

The design, development and analysis of the 7.3 MW MOD-5A wind turbine generator covering work performed between July 1980 and June 1984 is discussed. The report is divided into four volumes: Volume 1 summarizes the entire MOD-5A program, Volume 2 discusses the conceptual and preliminary design phases, Volume 3 describes the final design of the MOD-5A, and Volume 4 contains the drawings and specifications developed for the final design. Volume 1, the Executive Summary, summarizes all phases of the MOD-5A program. The performance and cost of energy generated by the MOD-5A are presented. Each subsystem - the rotor, drivetrain, nacelle, tower and foundation, power generation, and control and instrumentation subsystems - is described briefly. The early phases of the MOD-5A program, during which the design was analyzed and optimized, and new technologies and materials were developed, are discussed. Manufacturing, quality assurance, and safety plans are presented. The volume concludes with an index of volumes 2 and 3. Author

N86-27709# National Aeronautical Lab., Bangalore (India). Materials Science Div.
A SYSTEM FOR THE MEASUREMENT OF ABSOLUTE THERMOELECTRIC POWER
V. Shubha and T. G. Ramesh Mar. 1986 17 p
(NAL-TM-MT-8603) Avail: NTIS HC A02/MF A01

A precision system for the continuous and rapid measurement of absolute thermoelectric power (TEP) under controlled conditions of temperature and pressure has been developed. The design is centered around a fourth order polynomial curve fitting circuit which enables: (1) linearization of thermocouple-temperature characteristic, and (2) simulation of the variation with temperature of the relative TEP of the thermocouple and the absolute TEP of either of the constituents. Some typical data on the absolute TEP of cerium across the gamma-alpha transition is presented to demonstrate the performance of this system. Author

N86-27710# National Aeronautical Lab., Bangalore (India). Wind Energy Programme.
A CASE STUDY OF FIELD TESTING OF WINDPUMPS IN INDIA
Ar Venkatanarayana Feb. 1985 20 p
(NAL-TM-WE-8502) Avail: NTIS HC A02/MF A01

A tentative methodology for the testing of appropriate technology design windpumps and some early experience in operation of a relatively simple field test are described. This testing serves three purposes. One is comparative assessment under identical conditions. Second is keeping an impartial record of maintenance requirements. Third is to generate performance data to permit prediction of the quantity of water likely to be lifted on a gross, monthly basis at different places. The 10 minutes data generated intermittently can be utilized where velocity distribution profiles are known. This is the case at 37 places in India. But at another 317 places only monthly mean wind speeds are known. At these places 24-hourly performance data can be used in making first approximation of expected monthly outputs. Author

N86-27711# Research Triangle Inst., Research Triangle Park, N.C.
AN AlGaAs-GaAs PATTERNED Ge TUNNEL JUNCTION CASCADE CONCENTRATOR SOLAR CELL Annual Subcontract Report, 15 Oct. 1984 - 14 Oct. 1985
Jun. 1985 72 p
(Contract DE-AC02-83CH-10093)
(DE86-010699; SERI/STR-211-2932) Avail: NTIS HC A04/MF A01

The long-term goal of this research was to demonstrate a two-junction cascade solar cell (0.5 sq cm) composed of AlGaAs-GaAs having an AM2 conversion efficiency of more than 30%. As part of this work, Si has been selected as the best n-type dopant to date, and Mg, the best p-type dopant. B-doped, p(+)-Ge epilayers have been grown with mirror-like surface morphologies and hole concentrations above 10 to the 20 power/cu cm. Intercell ohmic connections have been fabricated using n(+)-GaAs/p(+)-Ge/p(+)-GaAs sandwiched structures. GaAs bottom cells having mirror-like surface morphologies have been grown with efficiencies of 8-12%. Al sub x Ga sub 1-x As top cells have also been obtained, but no satisfactory photovoltaic action has yet been measured. A complete Al sub x Ga sub 1-x/GaAs cascade cell using the patterned n(+)-GaAs p(+)-Ge/p(+)-GaAs sandwiched IOC has also been fabricated. Author

N86-27712# Army Engineer Div., Huntsville, Ala.
INTRODUCTION TO DIGITAL LOGIC SYSTEMS FOR ENERGY MONITORING AND CONTROL SYSTEMS
May 1985 84 p
(AD-A165540; HNDSP-85-ED-ME) Avail: NTIS HC A05/MF A01 CSCL 10/3

Recent advances in the state-of-the-art of digital electronic technology have made feasible the concept of distributed data processing in energy monitoring and control systems (EMCS). These advances were brought about largely due to the advent of micro-miniaturization of electronic integrated circuit components and the development of the microprocessor, a discrete semiconductor device with many of the capabilities of the central processing unit of the familiar mainframes of minicomputers, but vastly reduced in size and cost. It is now possible to design a reliable EMCS

consisting of a central computer control system and remote microcomputers which can perform many functions independent of the central system. When properly applied, these EMCS installations can aid significantly in conserving our dwindling sources of energy. GRA

N86-27713# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

SYSTEM PERFORMANCE AND COST SENSITIVITY COMPARISONS OF STRETCHED MEMBRANE HELIOSTAT REFLECTORS WITH CURRENT GENERATION GLASS/METAL CONCEPTS

L. M. Murphy, J. V. Anderson, W. Short, and T. Wendelin Dec. 1985 94 p

(Contract DE-AC02-83CH-10093)

(DE85-016892; SERI/TR-253-2694) Avail: NTIS HC A05/MF A01

Heliostat costs have long been recognized as a major factor in the cost of solar central receiver plants. Research on stretched membrane heliostats has been emphasized because of their potential as a cost-effective alternative to current glass/metal designs. However, the cost and performance potential of stretched membrane heliostats from a system perspective has not been studied until this time. The optical performance of individual heliostats is predicted here using results established in previous structural studies. These performance predictions are used to compare both focused and unfocused stretched membrane heliostats with state-of-the-art glass/metal heliostats from a systems perspective. We investigated the sensitivity of the relative cost and performance of fields of heliostats to a large number of parameter variations, including system size, delivery temperature, heliostat module size, surface specularity, hemispherical reflectance, and macroscopic surface quality. The results indicate that focused stretched membrane systems should have comparable performance levels to those of current glass/metal heliostat systems. Further, because of their relatively lower cost, stretched membrane heliostats should provide an economically attractive alternative to current glass/metal heliostats over essentially the entire range of design parameters studied. Unfocused stretched membrane heliostats may also be attractive for a somewhat more limited range of applications, including the larger plant sizes and lower delivery temperatures. DOE

N86-27714# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente und Zentrale Techn.

BASIC MATERIALS FOR SOLAR SILICON Final Report, Sep. 1983

Hubert Aulich, Wolfgang Dietze, Christa Grabmaier, Josef Grabmaier, and Werner Grimm Bonn Bundesministerium fuer Forschung und Technologie Nov. 1985 220 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-85-119; ISSN-0340-7608; ESA-86-96888) Avail: NTIS HC A10/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 38.50

High purity silicon dioxide and carbon were prepared using inexpensive raw materials to reduce solar cell costs, and reacted in an arc furnace under pure conditions to produce solar grade silicon. From pure natural quartz and purified carbon pellets, solar grade silicon was obtained which after two Czochralski pulls (crucible pulling) was converted into solar cells with an 11% efficiency. Silicon sheets (6 X 100 cm) were obtained by pulling a carbon fiber net through liquid silicon; this led to solar cells with 7% efficiency. Using finely powdered silicon as starting material, green foils were prepared, from which large grained silicon sheets (4 X 10 X 0.2 cm) were obtained by employing a sintering method. Using the roller-quenching technique, silicon ribbons (20 X 200 cm) were obtained, exhibiting suitable surface structure and grain size. ESA

N86-27715# Technischer Beratungsdienst der Steinbeis Stiftung, Mannheim (West Germany).

DEVELOPMENT OF A SIMPLE RADIATION SYSTEM BASED ON SYNTHETIC MATS Final Report, Jul. 1984

Konrad Abel, Armin Hampel, Walter Kerber, Damir Percornik, and Klaus Sattler Bonn Bundesministerium fuer Forschung und Technologie Nov. 1985 229 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-85-124; ISSN-0340-7608; ESA-86-96891) Avail: NTIS HC A11/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 39.50

Possibilities to use the physical effect of passive radiation cooling economically for space cooling in arid areas were investigated. Development of emitter layer configurations (coatings); computer models for optimization of the heat exchangers; and determination of design features for practical realization were studied. Practical tests prove that an economically feasible approach is possible with simple components. ESA

N86-27319*# North Carolina Agricultural and Technical State Univ., Greensboro. Student Space Shuttle Program.

MEASUREMENT OF THE HEAT PRODUCED INTERNALLY DURING DISCHARGE BY THE 6V EVEREADY ENERGIZER BATTERY, NO. 528

F. D. Hooker, K. R. Brooks, B. K. Burnette, J. D. Hampton, F. W. Crigler, and S. T. Ahrens *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium May 1986 p 177-184 (For primary document see N86-27297 18-12)

Avail: NTIS HC A13/MF A01 CSCL 22A

N86-27360# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. des Systemes Balistiques et Spatiaux.

SOLAR ARRAY DEPLOYMENT SIMULATION USING ADAMS SOFTWARE

C. Roux and P. Flament *In* ESA Second European Space Mechanisms and Tribology Symposium Dec. 1985 p 41-46 (For primary document see N86-27353 18-18)

Avail: NTIS HC A15/MF A01; ESA, Paris FF 150 or $18 Member States, AU, CN, NO (+20% others)

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N86-27716# San Diego State Univ., Calif. Systems Ecology Research Group.

RESPONSE OF ARCTIC ECOSYSTEMS TO ELEVATED CARBON DIOXIDE REGIMES Progress Report, 1 Jul. 1984 - 30 Jun. 1986

W. C. Oechel 1986 122 p

(Contract DE-AC03-82ER-60079)

(DE84-015237; DOE/ER-60079/T5) Avail: NTIS HC A06/MF A01

The goal of the project is to establish the effects of medium- and long-term field manipulations of CO2 in northern ecosystems so that total system interactions can be evaluated and the effect of elevated CO2 levels on carbon accumulation and species composition determined. DOE

N86-27717# Deutsche Babcock Anlagen A.G., Krefeld (West Germany). Produktbereich Gasreinigungsanlagen.

REDUCTION OF NOXIOUS GAS AND FINES EMISSION BY DRY SORPTION AND FILTERING DUST COLLECTORS INSTALLED BEHIND COMBUSTION PLANTS Final Report, Sep. 1982

Ulrich Glinka Bonn Bundesministerium fuer Forschung und Technologie Oct. 1985 144 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-85-121; ISSN-0340-7608; ESA-86-96889) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 30

A process for simultaneous removal of noxious gas and fines from flue gas dispensing with wet separation was developed. Two process variants were studied: Atomizing of an alkaline suspension

in the flue gas flow and drying of neutral salts by water evaporation, with salts removed in a fabric filter where they act as an additional fines filter and subsequent fixed-bed reactor; and injection of a dry alkaline sorbant into an evaporation cooler following flue gas conditioning by water injection. Dust is collected in a fabric filter. Maximum sorbant utilization is achieved by building up a filtering layer (fixed bed) and recirculating the dust collected. ESA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N86-27718 Engineering Sciences Data Unit, London (England).
QUADRATURE METHODS FOR THE EVALUATION OF DEFINITE INTEGRALS
Dec. 1985 46 p
(ESDU-85046; ISBN-0-85679-552-6; ISSN-0141-3988) Avail: ESDU

Data item ESDU 85046, Dynamics Sub-Series, considers the Newton-Cotes formulae, both open and closed types, in which the abscissae are equally spaced across the integration interval, and Gauss-Legendre formulae, in which the abscissae are unequally spaced and are determined from the roots of the Legendre polynomials. General expressions are given, and abscissae and weights for formulae are discussed. An adaptive integration scheme is also given that can distinguish regions in which the function varies rapidly and adapts the abscissa step lengths to meet a specified tolerance. It is shown how the methods can be modified to treat multiple integrals, and that the inner integration limits may be functions of the variable of the outer integral. Guidance is given on use for integration up to or across a singularity of the integrand. Computer program listings in FORTRAN are included for approximation of both a single and a double definite integral where the integration region may be rectangular or nonrectangular. An adaptive quadrature method based on Simpson's rule and its use is illustrated by practical worked examples. ESDU

N86-27719*# International Council of Scientific Unions, Urbana, Ill.
MIDDLE ATMOSPHERE PROGRAM. HANDBOOK FOR MAP. VOLUME 18: EXTENDED ABSTRACTS
S. Kato, ed. Dec. 1985 536 p Presented at MAP Symposium, Kyoto, Japan, 26-30 Nov. 1984 Sponsored in cooperation with UNESCO
(NASA Order W-15897)
(MAP-HANDBOOK-18) Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Various topics related to middle atmosphere research are discussed. Variability of the middle atmosphere during winter, climatology, gravity waves, atmospheric turbulence, transport processes of trace species and aerosols, and research in the Antarctic are among the topics covered. For individual titles, see N86-27720 through N86-27832.

N86-27720*# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie.
ON THE INTERANNUAL VARIABILITY OF THE MIDDLE ATMOSPHERE DURING WINTER
K. Labitzke *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 9 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Reference atmospheres such as the new CIRA (COSPAR International Reference Atmosphere), which will be based on global satellite data form a very useful basis for climatological studies. When using such climatologies it is important to be aware of the interannual variability which in the middle atmosphere is particularly large during the northern winters and southern springs. For a comparison of the two polar regions, the monthly mean temperature data for 90 deg N and 90 deg S are shown in the form of frequency distributions. The main features to be noted are: (1) in the middle stratosphere the variability during the northern midwinters is much larger than during the southern midwinters due to the major midwinter warmings which take place only during the northern winters (the largest variations over Antarctics are observed during late spring, i.e., October and November when very intense final warmings bring about the transition into summer); (2) the variability in the middle stratosphere is very small in summer when the planetary waves of the troposphere cannot propagate upwards into the stratosphere due to the prevailing easterly winds (this is true for both polar regions); and (3) the annual temperature range is larger over the South Pole, because winters are colder and summers warmer than over the North Pole. In addition, the Canadian, midwinter, and final warmings occurring during northern winters are characterized and the recent cooling trend in the arctic is discussed. Author

N86-27721*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MIDDLE ATMOSPHERE GENERAL CIRCULATION STATISTICS
Marvin A. Geller *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 1 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

With the increased availability of remote sensing data for the middle atmosphere from satellites, more analyses of the middle atmosphere circulation are being published. Some of these are process studies for limited periods, and some are statistical analyses of middle atmosphere general circulation statistics. Results from the latter class of studies will be reviewed. These include analysis of the zonally averaged middle atmosphere structure, temperature, and zonal winds; analysis of planetary wave structures, analysis of heat and momentum fluxes; and analysis of Eliassen-and-Palm flux vectors and flux divergences. Emphasis is on the annual march of these quantities; Northern and Southern Hemisphere asymmetries; and interannual variability in these statistics. Statistics involving the global ozone distribution and transports of ozone are also discussed. Author

N86-27722*# Kyoto Univ. (Japan). Geophysical Inst.
SEASONAL VARIATION OF THE STRATOSPHERIC CIRCULATION
I. Hirota and M. Shiotani *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

An extensive analysis is made of the extratropical stratospheric circulation in terms of the seasonal variation of large-scale motion fields, with the aid of height and temperature data obtained from the TIROS satellite. Special attention is paid to a comparison of climatological aspects between the Northern Hemisphere (NH) and the Southern Hemisphere (SH). In order to see the general picture of the annual mach of the upper stratosphere, the zonal mean values of geopotential height of the 1 mb level at 70 deg N and 70 deg S were plotted on the daily basis throughout a year. It is observed that, during the winter, the zonal mean 1 mb height in the NH is much more variable than that in the SH. It is also notable that the SH height is rather oscillatory throughout the longer period from midwinter to early summer. Since the zonal mean height in the polar latitude is a rough measure of the mean zonal flow in extratropical latitudes, the difference of the seasonal variation between the two hemispheres mentioned above is considered to be due mainly to the planetary wave-mean flow

interaction in the middle atmosphere. The wave activity in the middle atmosphere is represented more rigorously by the Eliassen-Palm flux associated with vertically propagating planetary waves forced from below. The day-to-day variation of the EP flux in the upper stratosphere shows that the wave activity varies intermittently with a characteristic time scale of about two weeks. Author

N86-27723*# Meteorological Office, Bracknell (England).
ASPECTS OF THE STRATOSPHERIC CIRCULATION AS DERIVED FROM SSU DATA
V. Michaelis and A. ONeill *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 1 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Five years of global data are available for the stratosphere up to 1 mb from Stratospheric Sounding Units (SSUs) on board NOAA satellites. These data form the basis for a climatological study which concentrates on the seasonal and inter-annual variability of the stratosphere and the connection between the stratospheric circulation and that of the troposphere. Particular emphasis is on the structure of the Southern Hemisphere and how it compares with that of the Northern Hemisphere. The characteristic difference in the vertical structure and propagation of disturbances in the two hemispheres is related to differences in the tropospheric flow and the long-term variation of the basic state of the stratosphere. Disturbances in both hemispheres occur in preferred geographical locations. The final warming, marking the transition from westerly to easterly winds, is an example. These occur asymmetrically with respect to the pole as warm air moves over the pole, usually from the same region. M.G.

N86-27724*# Ministry of Posts and Telecommunications, Ibaraki (Japan). Radio Research Labs.
THE SEASONAL VARIATION OF THE D REGION AS INFERRED FROM PROPAGATION CHARACTERISTICS OF LF RADIO WAVES
T. Ishimine, T. Ishii, and Y. Echizenya (Ministry of Posts and Telecommunications, Akita (Japan).) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 15-18 (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The propagation data of JG2AS 40 kHz (Japanese Standard Frequency), Loran C 100 kHz radio waves, and meteorological data were analyzed to study the association of propagation characteristics of LF radio waves with the atmospheric circulation in the mesosphere. The monthly averaged electric fields were depicted on the complex plane for typical summer and winter months, June and November. The locus traced out by the electric field vector during daytime is nearly circular. This is because during daytime the amplitude of the sky wave remains nearly constant while its phase changes in accord with the height change of the reflection layer, and thus the electric field vector traces out a circular locus with its center at the tip of the supposed ground wave vector. The locus has a loop during the sunrise or sunset period, which seems to arise from interference of two waves reflected by two different layers. In June the amplitude of the sky wave decreases rapidly before the dawn or increases after the dusk. In November such rapid change is not observed. During nighttime, the sky wave phase changes in such a way as to suggest that the reflection height moves upwards with time before midnight or lowers after midnight in November. In June it changes similarly before midnight, but after midnight it varies erratically. These characteristics are closely related to the structure of the D region, which is clearly shown by simulating the loci traced out by electric fields. Author

N86-27725*# Saskatchewan Univ., Saskatoon.
MEAN WINDS OF THE UPPER MIDDLE ATMOSPHERE (60-110 km): A GLOBAL DISTRIBUTION FROM RADAR SYSTEMS (M.F., METEOR, VHF)
A. H. Manson, C. E. Meek, M. Massebeuf (Centre National de la Recherche Scientifique, Paris (France).), J. L. Fellous, W. G. Elford (Adelaide Univ. (Australia).), R. A. Vincent, R. L. Craig, R. G. Roper (Georgia Inst. of Tech., Atlanta.), S. Avery (Colorado Univ., Boulder.), B. B. Balsley et al *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Since the development of the last CIRA in 1972, the number of radars providing winds in the upper middle atmosphere has increased significantly. These systems fill the data gap between 60 km and 110 km. The radars include medium frequency (MF) radars or partial reflection systems giving data from 60/70 to 100/110 km; meteor radars, 80 to 110 km, and M.S.T. radars operating as meteor radars. Data from 12 locations are shown, which represent a good Northern Hemispheric (NH) North American chain, an Oceanian chain which is mainly in the Southern Hemisphere (SH), and some Western Europe data. Generally tidal oscillations have been removed from days or groups of days, and the remaining mean winds and longer period oscillations plotted as height-time contours. Composite cross sections from the years 1978 to 1982 were formed where possible so that only the major temporal features remain. Author

N86-27726*# National Oceanic and Atmospheric Administration, Washington, D. C. Climate Analysis Center.
TRENDS IN UPPER STRATOSPHERIC TEMPERATURES AS OBSERVED BY ROCKETSONDES (1965-1983)
K. W. Johnson and M. E. Gelman *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Recent interest in possible anthropogenically induced changes in stratospheric ozone has led to a number of modeling studies. These studies indicate that stratospheric temperature changes would be related to stratospheric ozone changes. Therefore, this study was motivated by a concern to find out whether or not any significant trend in upper stratospheric temperatures could be ascertained from available observational data. June monthly mean values for 40 to 45 km layer were calculated for all Western Hemisphere rocketsonde stations for which data was available. Mean temperatures for each June were then used to calculate linear least squares regression coefficients with latitude of the stations as the independent variable. The resulting coefficients were used to calculate area-weighted mean temperatures for 25 deg N to 55 deg N. A two-to-three degree temperature drop in the early 1970s is indicated. It was noted, however, that this temperature decline coincides with a change in the principal observing system from the Arcasconde system to the Datasonde system. In order to study this temperature decrease more closely, similar mean temperatures were calculated for the 25 to 30 km layer using both rocketsondes and support radiosondes. Author

N86-27727*# Air Force Geophysics Lab., Hanscom AFB, Mass.
PROFILES OF TEMPERATURE AND DENSITY BASED ON EXTREMES AT 5, 10, 20, 30 AND 40 km
Arthur J. Kantor, Paul Tattelmann, and Frank A. Marcos *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Information on the vertical distribution of expected extremes of temperature and density are required for the design and operation of systems traversing the atmosphere. Such data are particularly important at altitudes from the surface to approximately 80 km for developing all types of airborne vehicles ranging from

helicopters and airplanes to sophisticated aerospace systems. Vertical profiles of temperature and density have been developed based on 1- and 10-percent hot and cold temperatures and 1- and 10- percent high and low densities occurring during the most severe month at the worst locations for which reliable upper-air data are available. The model profiles, from the surface to 80 km, are based on extremes that occur at 5, 10, 20, 30, and 40 km. There are 20 profiles for extreme temperatures (5 levels by 4 percentiles) that include associated densities, and 20 analogous profiles for extreme densities including associated temperatures. Consequently, a set of realistic profiles (rather than envelopes) of temperature and density, associated with extremes at each of 5 specified levels in the troposphere and stratosphere, are now available for altitudes up to 80 km. Author

N86-27728*# Indian Inst. of Tropical Meteorology, Poona.
INTERANNUAL VARIABILITY OF MIDDLE ATMOSPHERE DURING NORTHERN WINTER
B. K. Mukherjee, K. Indira, and Bh. V. Ramana Murty *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

An investigation was undertaken to examine the characteristics of the interannual variability of the zonal wind and the temperature of the middle atmosphere of the Northern Hemisphere during winter and to search for a relationship of the variability of the middle atmosphere with the activity of the following Indian summer monsoon. For this purpose, the rocketsonde temperature and wind data for 8 stations for a 6-year period for the month of January were collected. It is clear from the results that the interannual variability noticed in the zonal wind of the high latitude middle atmosphere was caused by the differential activity of the long-period planetary waves. In order to examine whether the stability of the polar night jet in the high latitude middle atmosphere has any influence on the spectacular tropospheric weather phenomenon such as the Indian summer monsoon, the rainfall activity for India has been studied. The study revealed that: (1) the strong and stable polar night jet with weak equator to pole temperature gradient at the stratopause in January was linked with the forthcoming weak monsoon activity; and (2) the weak and distorted polar night jet with strong equator-to-pole temperature gradient at the stratopause in January was linked with the forthcoming strong monsoon activity. M.G.

N86-27729*# Institut fuer Astrophysik und Extraterrestrische Forschung, Bonn (West Germany).
CONNECTION BETWEEN MESOPAUSE TEMPERATURE, CIRCULATION AND NOCTILUCENT CLOUDS
Volker Gartner and Michael Memmesheimer *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 7 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

To investigate the connection between mesopause temperature in summer and the induced circulation upon possible formation of the observed polar mesospheric (noctilucent) cloud layer (PMC), a two-dimensional semiempirical model is used to calculate the zonally averaged diabatic circulation. On the basis of the calculations, one may draw the following conclusions: (1) if the large departures from radiative equilibrium which occur at the summer mesopause at high latitudes should be balanced by adiabatic processes of the mean circulation alone, a vigorous circulation is needed (there is some evidence that such a vigorous circulation has been observed); (2) the vertical velocities of some cm/s at the polar summertime mesopause will support the formation of polar mesospheric clouds, because those large wind speeds support larger ice particles against gravitational sedimentation; and (3) a region of mild subsidence in the summertime midlatitude mesosphere due to the effect of nonlinear temperature advection would tend to limit the occurrence of ice particles to latitudes poleward of about 55 deg. M.G.

N86-27730*# Delhi Univ. (India). Dept. of Physics.
SOME STUDIES OF ZONAL AND MERIDIONAL WIND CHARACTERISTICS AT LOW LATITUDE INDIAN STATIONS
O. P. Nagpal and Somesh Kumar *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

At the beginning of the Indian Middle Atmosphere Programme (IMAP), it was decided that the preparation of consolidation reports of already available parameters for the middle atmosphere would be useful. Atmospheric wind data obtained by rockets and balloons constituted one such parameter which had to be consolidated. The present paper summaries the results of this consolidation study. Both zonal and meridional components of winds at four low latitude Indian stations namely Thumba, Shar, Hyderabad, and Balasore, have been analyzed to yield reference wind profiles for each month. The montly mean values have been used to bring out the amplitudes and phases of the annual, semiannual and quasi-biennial oscillations. Author

N86-27731*# Indian Space Research Organization, Trivandrum. Space Physics Lab.
TEMPORAL VARIATIONS OF THE TROPICAL TROPOPAUSE CHARACTERISTICS
B. V. Krishna Murthy, K. Parameswaran, and K. O. Rose *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 46-49 (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Results of a detailed study of tropopause characteristics at eleven Indian stations spread over a latitude range of 8.4 deg N to 28.6 deg N, using the data obtained during the period 1969 to 1978, are presented and discussed. This study reveals that the semiannual component in TP(T) (the tropopause potential temperature) can mainly be accounted by the corresponding variation on the solar insolation, whereas the annual component is greatly affected by the monsoon phenomenon, which is a large-scale annual one. During this period, the large-scale cloud cover would reduce the convective activity. Again, the annual components of TP(T) and lower stratospheric (18 km) potential temperature show a phase difference of about 6 months, except at the extratropical stations and about 2 to 3 months in the case of semiannual component. At extratropical stations the phase difference is much less, indicating the influence of convective process in the lower stratosphere. M.G.

N86-27732*# Boston Univ., Mass. Dept. of Elec., Computer and Systems Engineering.
MIDDLE ATMOSPHERE TIDES
Jeffery M. Forbes *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 7 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The recent direction of theoretical and observational research in middle atmosphere tides is reviewed. The diurnal tide has received considerable emphasis, including observations of evanescent components at high latitudes, numerical simulations of nonmigrating propagating components due to longitudinally varying water vapor insolation absorption in the troposphere, and implications and origins of unsteadiness in tidal oscillations over periods of days. Recent analyses of Nimbus 7 LIMS temperatures and partial reflection drift measurements of neutral winds in the tropical mesosphere have also emphasized the diurnal propagating tide. A description of the Atmospheric Tides Middle Atmosphere

Program (ATMAP) and an overview of ATMAP campaign results are also presented. M.G.

N86-27733*# Kyoto Univ. (Japan). Radio Atmospheric Science Center.

DIURNAL NONMIGRATING TIDES DUE TO LAND-SEA DISTRIBUTION

Toshitaka Tsuda and Susumu Kato *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

This paper is concerned with thermal excitation of diurnal nonmigrating tides by differential heating between land and sea. The nonmigrating tide is defined as a wave with a period corresponding to a subharmonic of a solar day. It is excited when heat sources of atmospheric tides have zonal asymmetries, and does not necessarily propagate westward with the Sun. Author

N86-27734*# Saskatchewan Univ., Saskatoon. Institute of Space and Atmospheric Studies.

MIDDLE ATMOSPHERE (60-110 km) TIDAL OSCILLATIONS AT SASKATOON, CANADA (52 DEG N, 107 DEG W) DURING 1983/84

A. H. Manson and C. E. Meek *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Since mid-1978, the medium frequency (2.2 MHz; M.F.) radar at Saskatoon has run continuously, measuring winds by the spaced antenna method in the upper middle atmosphere. As there is so much dynamics activity during the years of MAP it seems very important to establish the features of the tidal field at Saskatoon during 1983 to 1984, and compare these with the climatology from the four years 1978 to 1979 and 1981 to 1982. Wind profiles with 60 to 110 km (80 to 110 km at night) with 3 km resolution are obtained every 5 minutes by means of a full-correlation analysis. Hourly means are formed and harmonic analysis applied to sets of data to obtain the mean winds and tidal oscillation amplitudes and phases. The zonal wind field at Saskatoon is structurally similar to CIRA-72; however, the wind eastward cell is weaker and much more structured, and the summer eastward cell above 85 km is also weaker. For the semidiurnal tide, a strong seasonal change exists, with larger amplitudes and shorter wavelengths, in winter-like months and the reverse in summer-like months. A summary of the tidal parameters at 90 km is given, where mean values from 1978 to 1982 are also shown. This seasonal variation of tides is a midlatitude climatology, as comparisons with Monpazier, France and Christchurch, New Zealand show very similar behavior, as does Durham; and requires antisymmetric tidal modes such as 2,3 and 2,5. Considering the diurnal tide, for most months centered on summer there are long wavelength modes, or superposition of several models. However, some winter months show a short wavelength mode. A summary of the 90 km characteristics is presented. Author

N86-27735*# Kyoto Univ. (Japan). Radio Atmospheric Science Center.

MESOSPHERIC WINDS OBSERVED BY THE KYOTO METEOR RADAR

Toshitaka Tsuda and Susumu Kato *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The Kyoto meteor radar has been operated almost continuously from May 1983. By using a large amount of radar data, seasonal variations of mean winds, planetary waves and atmospheric tides can be delinated. Seasonal and latitudinal variation of tidally corrected mean winds including Kyoto observations have been examined in comparison with the CIRA 1972 model. A power spectral density of the zonal wind field for 60 days of data is formed from an autocorrelation function with a maximum time lag of 30 days. A quasi-2-day oscillation was evident in the period from June to September, and seems to be repeated in 1983 and 1983. It had large amplitudes in June and July and became weak in August; then it was again amplified in September. In summer months, the period of the wave was indicated as 2.2 days, and it became shorter in September. At Kyoto (35 deg N), the diurnal tide is the main component of atmospheric tides. The monthly mean amplitude of the eastward component of diurnal tide is plotted for the period from May 1983 to September 1984. It was clearly amplified in summer months at around 92 to 96 km altitudes. This feature was repeated in two successive years except for the maximum amplitude which exceeded 40 m/sec and 30 m/sec in 1983 and 1984, respectively. M.G.

N86-27736*# Calcutta Univ. (India).

SEMIDIURNAL TEMPERATURE OSCILLATION AND E-REGION ABSORPTION OVER HARINGHATA

N. N. Purkait *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 69-71 (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

An attempt has been made to explain the observed asymmetry in the diurnal curves on absorption for the E region at 2.2 MHz for the field station at Haringhata (22 deg 56'N, 88 deg 36'E). A comparison between the computed and observed diurnal curves on absorption revealed that a part of the asymmetry was a manifestation of the effect of semidiurnal temperature oscillation present in the E layer. It was further noted that the degree of the asymmetry of the observed diurnal curves depends profoundly on the rate of downwards phase progression of the temperature oscillation. M.G.

N86-27737*# Kyoto Univ. (Japan). Geophysical Inst.

NORMAL MODE ROSSBY WAVES OBSERVED IN THE UPPER STRATOSPHERE

Toshihiko Hirooka and Isamu Hirota *In* International Council of Scientific Unions Handbook for MAP Dec. 1985 4 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

In recent years, observational evidence has been obtained for westward traveling planetary waves in the middle atmosphere with the aid of global data from satellites. There is no doubt that the fair portion of the observed traveling waves can be understood as the manifestation of the normal mode Rossby waves which are theoretically derived from the tidal theory. Some observational aspects of the structure and behavior of the normal model Rossby waves in the upper stratosphere are reported. The data used are the global stratospheric geopotential thickness and height analyses which are derived mainly from the Stratospheric Sounding Units (SSUs) on board TIROS-N and NOAA satellites. A clear example of the influence of the normal mode Rossby wave on the mean flow is reported. The mechanism considered is interference between the normal mode Rossby wave and the quasi-stationary wave. M.G.

N86-27738*# Adelaide Univ. (Australia). Dept. of Physics.

ON THE INTERACTION BETWEEN THE QUASI-2-DAY WAVE AND THE MEAN FLOW

R. L. Craig, R. A. Vincent, and R. A. Plumb (Commonwealth Scientific and Industrial Research Organization, Mordialoc (Australia).) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP

Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Studies of the quasi-2-day wave show that it is a summertime phenomenon. Long-term measurement of the winds in the 60 to 100 km height range at Adelaide show that the wave appears in the late December but that the peak amplitudes are not reached until mid-January. In the summer of 1983 to 1984 the main phase of the wave appeared as a pulse in mid-January which lasted about 7 cycles (14 days). Little or no amplification with height was observed; peak amplitudes were about 60 m/s for the meridional and 20 m/s for the zonal component. Coincident with the onset of the pulse, a temporary but substantial change occurred throughout a deep layer of the upper mesosphere over a period of about 3 days. A change of more than 10 m/s occurred in the northward flow while the change in the zonal flow (about 30 m/s westward) actually caused a reversal of the prevailing zonal circulation. Author

N86-27739*# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Service d'Aeronomie.

PLANETARY WAVES-MEAN FLOW INTERACTION IN THE MIDDLE ATMOSPHERE: LIDAR OBSERVATIONS AND MODELISATION

A. Hauchecorne *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 9 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Lidar observations of the temperature from 30 to 80 km have been made at the Observatory of Haute-Provence on an operational basis since 1981. Data obtained during the four last winters indicate the quasi-systematic presence of traveling Rossby waves with periods ranging from 5 to 20 days and a vacillation of the zonal mean circulation leading to a succession of upper stratospheric warmings and associated mesospheric coolings spaced by 25 to 50 days. A semi-spectral model of the wave one-mean flow interaction has been used to interpret these results. When a stationary wave forcing is imposed at the lower boundary of the model, a vacillation of the zonal flow is obtained as soon as the amplitude of this wave reaches a critical value of about 140 m. When an 18-day westward traveling wave is imposed in supplement to this forcing, the date of occurrence of the upper stratospheric warmings is imposed by the coincidence of the phases of the two waves that enhanced the forcing. M.G.

N86-27740*# National Oceanic and Atmospheric Administration, Washington, D. C. Climate Analysis Center.

DISCRIMINATION OF A MAJOR STRATOSPHERIC WARMING EVENT IN FEBRUARY-MARCH 1984 FROM EARLIER MINOR WARMINGS

K. W. Johnson, R. S. Quiroz, and M. E. Gelman *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 7 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

As part of its responsibility for stratospheric monitoring, the Climate Analysis Center derives time trends of various dynamic parameters from NMC stratospheric analyses. Selected figures from this stratospheric monitoring data base are published in Climate Diagnostics Bulletin in March and October, after each hemispheric winter. During the Northern Hemisphere winter of December 1983-February 1984 several warming events may be seen in the plot of 60 deg. N zonal mean temperatures for 10 mb. Minor warmings may be noted in early December, late December, mid January and early February. A major warming with the 60 deg. N zonal mean temperatures reaching -40C is observed in late February, associated with a circulation reversal. In all of the minor warming episodes, there is a polarward movement of the Aleutian anticyclone; however, at 10 mb the North Pole remains in the cyclonic circulation of the stratospheric vortex which is not displaced far from its usual position. In the case of the later February major warming, the 10 mb circulation pattern over the North Pole is anticyclonic, and the cyclonic circulation has moved to the south and east with a considerable elongation. Cross sections of heat transport and momentum transport are not dramatically different for the minor and major warming episodes. Author

N86-27741*# Indian Inst. of Tropical Meteorology, Poona.

THE 4-5 DAY MODE OSCILLATION IN ZONAL WINDS OF INDIAN MIDDLE ATMOSPHERE DURING MONEX-79

R. S. Reddy, B. K. Mukherjee, K. Indira, and Bh. V. Ramana Murty *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

In the early studies based on time series of balloon observations, the existence of 4 to 5 day period waves and 10 to 20 day wind fluctuations were found in the tropical lower stratosphere, and they are identified theoretically as the mixed Rossby-gravity wave and the Kelvin wave, respectively. On the basis of these studies, it was established that the vertically propagating equatorial waves play an important role in producing the QBO (quasi-biennial oscillation) in the mean zonal wind through the mechanism of wave-zonal interaction. These studies are mainly concentrated over the equatorial Pacific and Atlantic Oceans. Similar prominent wave disturbances have been observed over the region east of the Indian Ocean during a quasi-biennial oscillation. Zonal winds in upper troposphere and lower stratosphere (10 to 20) km of the middle atmosphere over the Indian subcontinent may bear association with the activity of summer monsoon (June-September). Monsoon Experiment (MONEX-79) has provided upper air observations at Balasore (21 deg. 30 min.N; 85 deg. 56 min.E), during the peak of monsoon months July and August. A unique opportunity has, therefore, been provided to study the normal oscillations present in the zonal winds of lower middle atmosphere over India, which may have implication on large scale wave dynamics. This aspect is examined in the present study. Author

N86-27742*# Meteorological Office, Bracknell (England).

THE EVOLUTION OF ERTEL'S POTENTIAL VORTICITY DURING STRATOSPHERIC SUDDEN WARMINGS

T. D. A. Fairlie and A. ONeill *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 6 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

In the winter stratosphere of the Northern Hemisphere, the disruption of the westerly vortex and associated warming of polar latitudes is a well known phenomenon. It has become apparent that some important dynamical processes in the stratosphere are highly nonlinear and are best thought of locally rather than in terms of the interaction between the zonal-mean flow and harmonic waves around latitude circles. The importance of nonlinear processes was suggested by McIntyre and Palmer (1983, 1984) who used isentropic maps of Ertel's Potential Vorticity to show that during disturbed episodes material lines may become strongly and irreversibly deformed in certain places. They adopted the term planetary wave breaking to describe this process. Isentropic maps of Q are used to follow the evolution of a Canadian warming in November - December 1981 and a particularly strong warming in January 1982. The advection of Q over large distances on isentropic surfaces was a striking feature of the flow during each event. This could be identified because of our ability to follow the movement of material lines due to the approximate conservation of Q over several days. The advection of Q was a nonlinear process because its changing distribution affected the advecting wind field. The Canadian warming did not lead to a permanent change in the structure of the westerly vortex, as defined by the coarse-grain field of Q, whereas the January event was accompanied by a substantial loss of resolved Q which was never fully recovered. Author

N86-27743*# Meteorological Office, Bracknell (England).
SEASONAL CHANGES IN THE STRUCTURE OF THE STRATOSPHERIC CIRCULATION
A. ONeill and V. D. Pope *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The seasonal evolution of the stratospheric circulation in both hemispheres is studied using a coordinate independent diagnostic tied to the vortex, wherever it lies, rather than to latitude circles. Zonally averaged quantities are highly variable in the winter stratosphere, as the vortex moves on and off the pole, masking systematic changes in the structure of the vortex. The quantities shown here are the areas A(Q), where Ertel's potential vorticity is greater than a specified value Q, for various Q. In these calculations, Q is evaluated on the 850K isentropic surface which lies near 10 mb in the middle of the stratosphere. The advantage of using contours of Q (rather than contours of geopotential height, say) is that an area enclosed by such contours is approximately constant for quasi nondivergent, adiabatic, inviscid motion. Changes in area will occur if any of the above restrictions on the motion are invalid, and also if scales of motions are generated below those that can be adequately resolved. The evolution of area shows the systematic change in the average structure of the vortex. At a given time the rate of change of Q with A(Q) gives a measure of the average gradient of Q. The gradient of Q is relevant for the propagation of large-scale disturbances into the stratosphere. Experience has also shown that winds tend to be strong (weak) when the gradient of Q is strong (weak). Author

N86-27744*# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie.
ON THE USE OF POTENTIAL VORTICITY FOR THE DIAGNOSIS OF STRATOSPHERIC SYNOPTICS
K. Rose, K. Labitzke, and U. Kummel *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 7 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

According to quasi-geostrophic approximation, regions of strong cross flow gradient of geopotential vortivity support Rossby wave propagation. Using potential vorticity as a dynamical tracer, the polar vortex can be considered as a material entity. In addition to synoptic charts of geopotential heights and temperatures, maps of potential vorticity are used to describe some distinct features of the circulation of the winter stratosphere. Author

N86-27745*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INTEGRATED ENSTROPHY BUDGET OF THE WINTER STRATOSPHERE DIAGNOSED FROM LIMS DATA
Mark R. Schoeberl and Anne K. Smith (National Center for Atmospheric Research, Boulder, Colo.) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 1 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The quasi-geostrophic integrated enstrophy budget for the 1978 to 1979 winter has been analyzed from 10-0.1 mb using LIMS data. During January and late February periods a significant imbalance in the budget appears at 10mb. This imbalance is attributed to Rossby wave breaking. It is produced by the irreversible transfer of enstrophy to smaller scales not resolved by LIMS. The imbalance episodes correspond well to the appearance of Ertel vorticity filaments shown by McIntyre and Palmer (1984). From a seasonal viewpoint, the integrated enstrophy shows an average (although irregular) transfer from a zonal mean reservoir to waves which are then dissipated. On a shorter time scale the integrated enstrophy sloshes back and forth between the waves and mean flow in early winter; then, beginning with the January sudden warming, the total enstrophy is reduced more rapidly. Between 10 mb and 1 mb this reduction is more or less continuous until the end of February. However, in the mesosphere the total enstrophy decrease is very short lived, being quickly restored after the January warming. Even though the zonal mean integrated enstrophy is large, only about 10% can be utilized by the waves. The available integrated potential enstrophy is introduced, which is a better measure of how close the flow is to saturation by Rossby waves. The largest amount of available potential enstrophy in early January is at 1 mb with decreasing amounts above and below. Saturation of the flow by Rossby waves occurs below 1 mb only coincident with sudden warmings; however, at mesospheric heights the flow appears to be nearly saturated throughout the winter. Author

N86-27746*# Kyoto Univ. (Japan). Geophysical Inst.
PLANETARY WAVE-MEAN FLOW INTERACTION IN THE STRATOSPHERE: A COMPARISON BETWEEN THE NORTHERN AND SOUTHERN HEMISPHERES
M. Shiotani and I. Hirota *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Based on satellite-derived data supplied by the National Meteorological Center (NMC), the dynamical interaction between planetary waves and mean zonal winds in the stratosphere is investigated. Special attention is paid to the differences between the Northern Hemisphere (NH) and the Southern Hemisphere (SH). An analysis is made using Eliassen-Palm (E-P) flux diagnostics for the period from June 1981 to May 1982. In a climatological sense, different seasonal evolutions of large-scale motions between the NH and the SH in the stratosphere are demonstrated. Vertical cross-section analysis is presented to show the day-to-day variation in the mean zonal wind and wave activity, in particular, the following phenomena: (1) the poleward shifting of the westerly jet, and (2) episodes after the shifting of the westerly jet. Author

N86-27747*# Meteorological Research Inst., Tsukuba (Japan). Forecast Research Div.
WAVE-MEAN FLOW INTERACTION DURING THE WINTER TO SUMMER TRANSITION IN THE SOUTHERN HEMISPHERE STRATOSPHERE
K. Yamazaki *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The evolution of the flow and wave-mean flow interactions in the Southern Hemisphere during the period when the final stratospheric warming and the associated reversal of the flow in the upper stratosphere occurred is described. The spring is the most interesting season as far as the wave mean flow interaction in the Southern Hemisphere is concerned. The data for this study are NMC analysis of temperature and geopotential fields between 1000 and 0.45 mb for the period August 31 to November 10, 1979. Author

N86-27748*# Washington Univ., Seattle.
A NEW MODEL OF RESONANCE IN THE WINTER STRATOSPHERE
Peter H. Haynes *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 6 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

It is generally accepted that the planetary waves observed in the winter stratosphere are primarily a response to dynamical forcing from the troposphere. Nevertheless, the mechanism by

which wave amplitudes sometimes become larger remains uncertain. It is possible that anomalously large waves in the stratosphere might simply be the result of anomalously large tropospheric forcing. However, it has also been suggested that they are a response to a stratospheric-tropospheric cavity being in a near-resonant configuration. It has been suggested that nonlinear self-tuning effects could play an important role in the behavior of such a cavity. Self-tuning may occur when a system starts to one side of resonance, such that the mean-state change induced by growing waves brings the system closer to resonance. A new model of the stratospheric cavity is introduced and is then used to re-examine the possibility of wave growth in the real atmosphere and in atmospheric models due to self-tuning effects. The new model is based on the picture of the winter-time stratosphere which has been revealed by the observations of Ertel's potential vorticity, Q. Isentropic maps of Q show two rather distinct regions, the first containing the circumpolar vortex, where gradients of Q are large and Rossby waves may propagate easily. Surrounding this is a second, low-latitude region where the gradients are generally weak and where, because the Eulerian-mean flow is comparable with their phase speed, Rossby waves must be continually breaking. As the waves are observed to grow the relative sizes of these two regions change in time. This leads to the interesting possibility that self-tuning, mainly due to irreversible changes in the size of the polar vortex, is taking place. Author

N86-27749*# Colorado Univ., Boulder. Dept. of Astrophysics, Planentary and Atmospheric Science.

TRANSIENT RESPONSE TO LOCALIZED EPISODIC HEATING IN THE TROPICS

Murry L. Salby and Rolando R. Garcia (National Center for Atmospheric Research, Boulder, Colo.) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 8 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

It is generally recognized that equatorial disturbances in the lower stratosphere are excited by convective latent heat release associated with the Internal Tropical Convergence Zone (ITCZ). Recently, attention has also focused on tropical convection with regard to extratropical teleconnection patterns. Unlike equatorial waves which are trapped about the equator but propagate vertically, the latter extend well out of the tropics but are barotropic. They have been most widely discussed in connection with long-term climatological features. Both types of disturbances have been examined largely from the standpoint of steady monochromatic forcing, in the latter case zero frequency or time-mean heating. However, tropical convection as revealed by recent geostationary satellite imagery is anything but regular, surely not steady. Much of the heating variance is concentrated spatially within three localized convective centers: Indonesia, the Amazon, and the Congo. Convective activity within these regions undergoes an irregular evolution over the span of a couple of days. It involves a rather broad spectrum of spatial and temporal scales. The analysis of cloud brightness over the Eastern Atlantic and Africa suggests a characteristic time scale of 3-4 days and correlations scales in latitude and longitude of approximately 30 deg. Author

N86-27750*# Oxford Univ. (England). Dept. of Atmospheric Physics.

ROSSBY WAVETRAINS IN THE STRATOSPHERE FORCED BY LOCALISED DISTURBANCES IN THE TROPOSPHERE

C. J. Marks, A. ONeill (Meteorological Office, Bracknell, England), and V. D. Pope *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Studies have linked elements of the stratospheric circulation with particular localized features in the tropospheric circulation. This suggests a study of the response of the stratosphere to forcing by localized disturbances in the troposphere. A multilevel, primitive equation model is used of the stratosphere and mesosphere the height of whose lower boundary at 300 mb can be prescribed. Localized height disturbances which grow to steady amplitude are applied at this lower boundary, and the response of the initially axially symmetric stratosphere is studied. The perturbation, centered at 45 deg N, has a Gaussian distribution with a half width of 15 deg., corresponding roughly to the size of persistent troughs and blocking ridges in the troposphere. The forcing is nearly at fully amplitude 10 days after being switched on, and thereafter remains steady. Two types of experiments are conducted: in one the forcing is of small amplitude (100 gpm) and in the other it is of large amplitude (600 gpm). These pairs of experiments are compared to determine how nonlinear processes affect the perturbation fields. This is done locally by defining the perturbation response to the forcing as an anomaly, i.e., as a departure from the response in a controlled experiment in which no asymmetric forcing was applied at the lower boundary of the model. Experiments have been conducted for a number of atmospheric states obtained as zonal means of observations made by a stratospheric sounding unit (SSU). In this summary, results for the zonal mean flow on January 19, 1982 are outlined. Author

N86-27751*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.

LOW-FREQUENCY DYNAMICS OF QUASI-GEOSTROPHIC WAVES IN A MIDLATITUDE CHANNEL AND THE EFFECTS OF TROPICAL INFLUENCE

K. K. Tung and A. J. Rosenthal *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 145-154 (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Both zonal mean flow and stationary waves in the stratosphere have large variabilities from month to month and from year to year. One plausible mechanism that can account for these variabilities is the interaction between the forced stationary waves and the mean zonal flow. Given the large energy source contained in the stationary waves which are forced in the lower atmosphere, they are probably responsible for inducing the bulk of the variability in the mean flow in the stratosphere. Variability in the mean flow can in turn produce variability in the stationary wave amplitudes due to the possible sensitivity of wave response in the stratosphere to the configuration of the wave guide determined by the mean flow. The likely causes for the low-frequency variability of the stationary waves-mean flow system in extratropical latitudes are assessed. The causes of variability are divided into internal and external ones. Internal mechanisms include transition between equilibria and vacillation cycles, while mechanisms external to the midlatitude system include eddy heat and momentum fluxes from the tropics and the Hadley circulation forced in the tropics. Author

N86-27752*# Princeton Univ., N. J. Geophysical Fluid Dynamics Program.

SUPPRESSION OF STATIONARY PLANETARY WAVES BY INTERNAL GRAVITY WAVES IN THE MESOPHERE

Saburo Miyahara *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 154-156 Prepared in cooperation with Kyushu Univ., Fukuoka, Japan (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The supression of stationary planetary waves by internal gravity waves in the mesosphere is treated using a quasi-geostrophic model on a midlatitude beta-plane. The drag forces due to internal gravity waves are parameterized based on the wave-breaking assumption proposed by Lindzen (1981). In the present model the vertical propagation of internal gravity waves is affected not only by mean zonal wind distribution but also by eastward and northward velocity perturbations associated with stationary plane-

tary waves, viz. the total local velocity. Only two stationary upward propagating internal gravity waves with the same horizontal wavelength 57 km, but whose wave number vectors are different are considered. One component has a wave number vector which is directed towards northeast, and the other is directed southeast. Planetary waves with zonal wave number 1 are considered, and the amplitudes of the geopotential height at the bottom (z=20km) are specified to be 50 m. Author

N86-27753*# Kyushu Univ., Fukuoka (Japan). Dept. of Physics.

MEAN ZONAL WINDS AND PLANETARY WAVES INDUCED BY INTERNAL GRAVITY WAVE PACKETS

M. Takahashi and M. Uryu *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The generation of mean zonal winds and planetary waves induced by internal gravity wave packets are investigated by numerical experiments. The numerical model is a 3-dimensional primitive equation model on the equatorial beta-plane with boundaries at the equator and North Pole. Because of equatorial boundary conditions, equatorial symmetric modes only are included in the model. Internal gravity wave packets are produced by thermal heating at the bottom boundary. Because of restriction of grid size, convective instability is parameterized by time-independent vertical and horizontal eddy viscosity. Other dissipation mechanisms (e.g., Newtonian cooling, ion drag, molecular viscosity etc.) are also included in the model. Author

N86-27754*# National Center for Atmospheric Research, Boulder, Colo.

WAVE-MEAN FLOW INTERACTION IN THE NCAR STRATOSPHERIC GENERAL CIRCULATION MODEL

Byron A. Boville *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 161-168 (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A version of the NCAR General Circulation Model has been developed which extends from the surface into the mesosphere. The model was forced by climatological January sea surface temperatures and insolation and gives a fairly reasonable simulation of the troposphere and stratosphere. The transformed Eulerian formation is used to examine the interaction of the eddies with the mean flow in the winter hemisphere. The essence of the transformed Eulerian formation is an attempt to distinguish between the mean meridional circulation driven by diabatic heating and that driven by eddies. The net effect of eddies can then be determined, and is given by the Eliassen-Palm (EP) flux divergence. In practice, this method works reasonably well but is far from perfect. For instance, in the absence of eddy forcing, the winter stratosphere would go to radiative equilibrium and there would be no diabatic heating to drive a mean meridional circulation. Author

N86-27755*# National Center for Atmospheric Research, Boulder, Colo.

EQUATORIAL WAVES IN THE NCAR STRATOSPHERIC GENERAL CIRCULATION MODEL

Byron A. Boville *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Equatorially trapped wave modes are very important in the tropical stratospheric momentum balance. Kelvin waves and mixed Rossby-gravity waves are believed to be responsible for the quasi-biennial oscillation of the zonal winds in the equatorial lower stratosphere. Both Kelvin and mixed Rossby-gravity waves have been identified in observations and in numerical models. Kelvin and mixed Rossby-gravity waves are identified in a general circulation model extending from the surface into the mesosphere and looks at the effect on the waves of lowering the top of the model. Author

N86-27756*# Colorado Univ., Boulder. Dept. of Astrophys., Planetary and Atmosph. Sci.

VACILLATIONS INDUCED BY INTERFERENCE OF STATIONARY AND TRAVELING WAVES

Murry L. Salby and Rolando R. Garcia (National Center for Atmospheric Research, Boulder, Colo.) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

It was shown that there exists a correspondence between interference of the 16-day wave with the stationary planetary wave and vacillations in eddy heat and momentum fluxes. There has been speculation on the role such interference may play in stratospheric warmings. The appearance of higher-order normal modes, e.g., the 16-day wave, prior to disturbances in the stratospheric vortex has also been noted. Since amplitudes of the 16-day wave are compared to those of the stationary component, it can significantly alter the instantaneous total wave field. The behavior of the wave number 1 height field at 60 deg N during January 1979 is shown when a large amplitude disturbance retrogressed barotropically around the globe over much of the troposphere and stratosphere. This transient disturbance has been identified with the 16-day wave. More generally, the presence of fluctuating planetary wave activity can, through combined interference, alter the instantaneous planetary wave field as well as the transports it produces. The implications of such interference in a quasi-geostrophic framework has been explored, using the Eliassen-Palm (EP) flux as a diagnostic. Author

N86-27757*# Kyushu Univ., Fukuoka (Japan). Dept. of Physics.

OVER-REFLECTION OF BAROTROPIC ROSSBY WAVE PACKET

K. Takano and M. Uryu *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Interference of stationary and traveling waves of sufficiently large amplitude can cause vacillations in the instantaneous EP-flux and its divergence. Such fluctuations may provide an explanation for some of the vacillations in transport and in the mean flow observed in the stratosphere. While there has been a focus on a simple two-component system, in reality several spectral components are likely to be present. For sufficiently large mean flow deceleration, the local wave field and the quasi-linear description developed here would presumably break down. Author

N86-27758*# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.

EFFECTS OF RAYLEIGH AND NEWTONIAN DAMPING ON WAVE-MEAN FLOW INTERACTION

Yoshikazu Hayashi *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A theoretical study is made of the effects of mean damping on wave-mean flow interactions. A condition is derived for the Eliassen-Palm flux divergence to balance the steady-state residual circulations induced by eddies in the presence of mean damping. It is shown by a simple analytical model that this balance holds for stratospheric planetary waves when the Rayleigh friction

coefficient is one order smaller than the Newtonian cooling coefficient, although the tall mean flow condition is not violated. In this case, the Eliassen-Palm flux divergence can be interpreted as approximating the steady residual circulation (approximately equal to Lagrangian-mean circulations) induced by eddies as well as the net mean acceleration in the absence of mean damping. This balance is consistent with the stratospheric circulations of a dynamical model. Author

N86-27759*# Kyoto Univ. (Japan). Data Analysis Center Geomagnetism and Spacemagnetism.

VARIATION OF TIDAL WINDS IN THE IONOSPHERE INFERRED FROM GEOMAGNETIC SQ FIELD

M. Takeda and T. Araki *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 182-185 (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The geomagnetic Sq field is mainly generated by the dynamo action of tidal winds in the ionosphere, and therefore some information can be derived from the variation of the Sq field. The geomagnetic Sq field was analyzed during March 1 to 18, 1980, when the geomagnetic activity was exceptionally low, and the equivalent Sq currents calculated every 2 hours by using the spherical harmonics method. Then additional Sq currents were extracted by subtracting the currents averaged through all days in the period from the original currents at each UT. The change of the instantaneous Sq current system by the above-mentioned method is discussed. Author

N86-27760*# Meteorological Research Inst., Yatabe (Japan).

INFLUENCE OF GEOMAGNETIC DISTURBANCE ON ATMOSPHERIC CIRCULATION

Kunihiko Kodera *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 186-189 (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The influence of geomagnetic disturbance or passage of the solar sector boundary on the atmospheric circulation was reported. Unfortunately little is known about the general morphology of Sun weather relationships. In order to know the general characteristics, pressure height variations on an isobaric surface over the Northern Hemisphere were analyzed. Although it may be suitable to use some index, or some integrated value for statistical purposes, weather prediction data were used to verify whether the obtained tropospheric response is caused externally or not. Author

N86-27761*# Indian Inst. of Tropical Meteorology, Poona.

BEHAVIOR OF NEUTRAL WIND GRADIENTS AT METEOR HEIGHTS OVER MIDLATITUDE STATIONS

P. C. S. Devara, G. Chandrasekhar (Andhra Univ., Waltair, India), and M. I. Ahmed *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 6 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The variation of wind gradients in the altitude range of 80 to 100 km, which contributes information on propagational characteristics of wave phenomena prevailing at those altitudes, was studied. Diurnal and semidiurnal components of the zonal (EW) and meridional (NS) neutral wind data collected over Atlanta using the Georgia Tech Meteor Wind Radar Facility during the period of August 1974 through March of 1978 over the height range of 80 to 100 km are analyzed in detail to obtain information on height gradients in amplitude and phase of neutral wind components over height intervals of 80 to 90 and 90 to 100 km. The details of the data analysis, major results, and conclusions are presented. Author

N86-27762*# Adelaide Univ. (Australia). Dept. of Physics.

RADAR OBSERVATIONS OF MESOSPHERIC GRAVITY WAVES AND TURBULENCE AT ADELAIDE

R. A. Vincent *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Recent studies made at Adelaide (35 deg S, 138 deg E), of gravity waves and turbulence in the 60 to 100 km altitude range are reviewed. The observations were made with a radar operating at 2 MHz and both the spaced antenna (SA) and Doppler techniques were used. The SA observations were made on a continuous real time basis from November 1983 to December 1984 with a time resolution of 10 min and a 2 km height resolution. The Doppler observations were made on a campaign basis and were used to study gravity wave momentum fluxes with the dual-beam technique of Vincent and Reid (1983) and also turbulence dissipation rates. Author

N86-27763*# Kyoto Univ. (Japan). Radio Atmospheric Science Center.

THE MU RADAR: CURRENT STATUS AND FIRST RESULTS c32

Susumu Kato, Shoichiro Fukao, Toshitaka Tsuda, and Toru Sato *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The MU (Middle and Upper Atmosphere) radar is a 46.5 MHz pulse modulated monostatic Doppler radar with an active phased array system. The nominal beam width is 3.6 deg, and the peak radiation power is 1 MW with maximum average power of 50 kW. A brief description of the system and the initial observational results are presented. Author

N86-27764*# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).

POWER SPECTRA OF MESOSPHERIC VELOCITIES IN POLAR REGIONS

P. Czechowsky and R. Ruster *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The mobile SOUSY radar was operated on Andoya in Northern Norway during the MAP/WINE campaign from November 1983 to February 1984 and for about two weeks in June 1984 to study the seasonal dependence of mesospheric structures and dynamics at polar latitudes. During the winter period, measurements were carried out on 57 days, primarily in coordination with the schedule of the rocket experiments. Echoes were detected in the troposphere and stratosphere up to 30 km and at mesospheric heights from about 50 to 90 km with a distinct maximum around noon. In summer, the radar system was operated continuously from 19th to the 28th of June 1984. Echoes occurred almost for 24 hours in the height range from 70 to 95 km showing no recognizable diurnal variation. Similar observations in polar latitudes were carried out for several years with the Poker Flat Radar in Alaska. Author

N86-27765*# National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.

GRAVITY WAVE SPECTRA OBSERVED BY DOPPLER RADAR: COMPARISON OF A MODEL WITH MESOSPHERIC OBSERVATIONS

T. E. VanZandt, S. A. Smith (Alaska Univ., Fairbanks), and D. C. Fritts *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719

18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

It was proposed that mesoscale fluctuations of wind and temperature in the free atmosphere are due to gravity waves. Critical tests of this hypothesis must involve the comparison of models based on the theory of buoyancy waves with suitable measurements. The MST (mesosphere-stratosphere-troposphere) radar technique is particularly attractive for this purpose, because it can measure several independent power spectra simultaneously. Observed spectra are derived from mesospheric data taken by the Poker Flat MST radar during June 1983. The spectra were compared with the model spectra for three days when suitable data were available. It was concluded that the mesoscale fluctuations were dominated by gravity waves, and the contribution of two-dimensional turbulence was small. B.G.

N86-27766*# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
INSTABILITIES AND TURBULENCE AT MESOSPHERIC HEIGHTS AS OBSERVED BY VHF RADAR
R. Ruster and J. Klostermeyer *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Very High Frequency (VHF) radar operating at frequencies near 50 MHz can simultaneously measure mean winds, waves, and turbulence at scales equal to half the radar wavelength. Harper and Woodman (1977) pointed out that short-period evanescent gravity waves act as a direct energy source for turbulence at mesospheric heights. A few examples of observational results of strong mesospheric turbulance bursts are presented and compared with recently observed turbulence bursts in a tropospheric jet stream to gain insight into the generation mechanism. Author

N86-27767*# Academia Sinica, Beijing (China). Institute of Atmospheric Physics.
OBSERVATION AND ANALYSIS OF THUNDERSTORM-GENERATED GRAVITY WAVES IN THE LOWER STRATOSPHERE
Daren Lu, T. E. VanZandt (National Oceanic and Atmospheric Administration, Boulder, Colo.), and W. L. Clark, Jr. *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 6 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The relation between internal gravity waves and thunderstorms may be important in at least two respects. First, thunderstorm cells could be excited or initiated by propagating gravity waves in the troposphere. Second, thunderstorms may contribute to the energy of the atmospheric gravity wave field. Observations of gravity waves associated with thunderstorms are analyzed. The analysis will emphasize the difference of thunderstorm-generated gravity waves in the troposphere and lower stratosphere. B.G.

N86-27768*# Saskatchewan Univ., Saskatoon.
GRAVITY WAVES OBSERVED WITH GRAVNET: SASKATOON (52 DEG N, 107 DEG W) 1983/84
C. E. Meek, A. H. Manson, and I. M. Reid *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 6 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The GRAVNET system is based on a medium frequency (MF) radar (2.22 MGz) with one site consisting of a transmitting and spaced receiving antenna; and two remote receiving sites (approximately 40 km distance, forming an approximately equalateral triangle), also spaced receiving antennas. The winds of the upper middle atmosphere (60 to 110 km) are measured at each of the three sites in real time, using the Spaced Antenna method. Up to 12 profiles per hour were obtained. Spectral analysis was performed separately on northward and eastward velocity components for each site at the same height. Cross spectra are then found between sites. Data selection criteria included the Normalized Phase Discrepancy (NDP). B.G.

N86-27769*# International Council of Scientific Unions, Urbana, Ill. Water Research Inst.
HIERARCHICAL STRUCTURE OF STRATOSPHERIC WIND FLUCTUATIONS
M. D. Yamanaka and H. Tanaka *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 50-46 (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

In order to verify the gravity-wave-breaking theories, high resolution observations of middle-stratospheric winds were carried out by balloon-borne anemometers. The observed features were summarized, the parameters of waves generating the turbulence were estimated, and the effect on the general circulation and the transport process were discussed. Author

N86-27770*# University of Electro-Communications, Tokyo (Japan). Dept. of Applied Electronic Engineering.
TWO CLASSES OF MEDIUM-SCALE TRAVELING IONOSPHERIC DISTURBANCES OBSERVED WITH AN ARRAY ON HF-DOPPLER SOUNDERS
T. Shibata and T. Okuzawa *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The importance of the quasi-evanescent mode of acoustic-gravity waves (AGW) was recently stressed to elaborate on the daytime dispersion characteristics of horizontal velocity of medium-scale traveling ionospheric disturbances (MS-TID) which were observed by a high frequency Doppler (HFD) sounder array in central Japan. Observed MS-TIDs were classified into two categories: the internal mode and the quasi-evanescent mode as regards physical implication. Nonlinear wave-wave interaction is proposed in an attempt to explain salient features of the latter-class TID. Author

N86-27771*# National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.
FINITE AMPLITUDE GRAVITY WAVES: HARMONICS, ADVECTIVE STEEPENING, BREAKING AND SATURATION
J. Weinstock *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A simple theory is presented which determines details of the breaking and saturation of a gravity wave as it propagates upward in the atmosphere. Breaking and saturation are here due to nonlinear advection analogous to the breaching of a surface wave and to the breaking of a planetary wave. Much simplification is obtained by the assumption that in a wave packet consisting of a primary wave and its harmonics, the primary wave remains dominant. This assumption, referred to a quasi-monochromatic approximation, is suggested by observations. Determined by this approximate theory are: a detailed picture of the waveform as it steepens and breaks; harmonics of the wave; the turbulence generation; and an underlying relationship between superadiabatic lapse rate and saturation by wave-wave interactions. Author

N86-27772*# Adelaide Univ. (Australia). Institute for Antarctic Research.

GRAVITY WAVE VERTICAL ENERGY FLUX AT 95 km

P. G. Jacob and F. Jacka *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A three-field photometer (3FP) located at Mt. Torrens near Adelaide, is capable of monitoring different airglow emissions from three spaced fields in the sky. A wheel containing up to six different narrow bandpass interference filters can be rotated, allowing each of the filters to be sequentially placed into each of the three fields. The airglow emission of interest is the 557.7 nm line which has an intensity maximum at 95 km. Each circular field of view is located at the apexes of an equilateral triangle centered on zenith with diameters of 5 km and field separations of 13 km when projected to the 95-km level. The sampling period was 30 seconds and typical data lengths were between 7 and 8 hours. The analysis and results from the interaction of gravity waves on the 557.7 nm emission layer are derived using an atmospheric model similar to that proposed by Hines (1960) where the atmosphere is assumed isothermal and perturbations caused by gravity waves are small and adiabatic, therefore, resulting in linearized equations of motion. In the absence of waves, the atmosphere is also considered stationary. Thirteen nights of quality data from January 1983 to October 1984, covering all seasons, are used in this analysis.

Author

N86-27773*# Tokyo Univ. (Japan). Upper Atmosphere and Space Research Lab.

WAVE MOTIONS IN THE UPPER ATMOSPHERIC SODIUM LAYER OBSERVED WITH A LIDAR TECHNIQUE

Hiroshi Kamiyama and Fumihiko Tomita (Ministry of Posts and Telecommunications, Tokyo, Japan) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 6 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Since the middle of 1980, the vertical profile of the atmospheric sodium layer was observed with a tunable laser radar at Mt. Zao Observatory in northern Japan. The principal characteristics of the lidar system are summarized. The output wavelength is continuously monitored by using a sodium resonance cell, a spectrometer, and a Fabry-Perot interferometer provided with the reference spectrum of the sodium lamp. Owing to the strict temperature control of the filters, the tuning is sufficiently stable throughout the night. The calibration of the absolute sodium density was carried out by adopting the method established by previous works.

Author

N86-27774*# National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.

TROPOSPHERIC GRAVITY WAVES OBSERVED BY THREE CLOSELY-SPACED ST RADARS

D. A. Carter, B. B. Balsley, W. L. Ecklund, M. Crochet (Toulon Univ., La Garde, France), A. C. Riddle (Colorado Univ., Boulder), and R. Garello *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

During a 6 week period in 1982, 3 ST (Stratosphere-Troposphere) radars measured horizontal and vertical wavelengths of small scale tropospheric gravity waves. These 50 MHz, vertically-directed radars were located in a trianglar network with approximately 5 km spacing on the southern coast of France at the mouth of the Rhone River during the ALPEX (Alpine Experiment) program.

Author

N86-27775*# Wuhan Univ. (China). Dept. of Space Physics.

THE ACOUSTIC GRAVITY WAVE INDUCED BY A POINT SOURCE IN THE MIDDLE ATMOSPHERE

Xun Jie Zhang and Nian Lu Xiong *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 9 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Acoustic gravity wave (AGW) results computed for a stationary impulsive point source and a moving point source in the middle atmosphere are presented. For a stationary impulsive point flow's far field formula of the AGW was extended into the near field one, which comprises the Zeroth order Bessel function and its derivative terms. When (t-t sub o) is not large, the contribution of the derivative terms is important. The computed results agree with the experimental ones. For a moving point source with supersonic velocity, AGW is calculated using the moving point theory. Two solar eclipses that occurred in the lower latitude and over the ocean on Feb. 16, 1980, and June 11, 1983, were compared. The results show that the theoretical curve of AGW is fairly consistent with the observed ones.

Author

N86-27776*# Meteorological Research Inst., Yatabe (Japan).

A NUMERICAL STUDY OF NONLINEAR INTERACTIONS BETWEEN MEAN FLOW AND BREAKING INTERNAL GRAVITY WAVES

Hideji Kida *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 273-280 (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Internal gravity waves are one of the important phenomena in understanding the general circulation as well as eddy motions in the atmosphere, particularly in the mesosphere and lower thermosphere. Therefore, in order to reproduce the middle atmospheric general circulation, it is necessary to incorporate vertically propagating internal gravity waves into general circulation models (GCMs). Results from numerical simulations on nonlinear interactions between mean flow and internal gravity waves are briefly presented.

Author

N86-27777*# National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.

EFFECTS OF BREAKING GRAVITY WAVES ON THE CHEMICAL COMPOSITION OF THE MESOSPHERE AND LOWER THERMOSPHERE

S. Solomon and R. Garcia (National Center for Atmospheric Research, Boulder, Colo.) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 1 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Eddy diffusion and momentum forcing in the mesosphere and lower thermosphere arise principally from the effects of breaking gravity and waves. The propagation and dissipation of gravity waves depend strongly on season and latitude because of its relationship to the background zonal wind. These processes have significant effects on the transport of chemical species in that region, so that observations of variations in chemical constituents provide useful tracers for dynamical theory. A parameterization of gravity wave propagation and dissipation was incorporated in the coupled dynamical-chemical model to study these effects. Several easily observable airglow features of the mesosphere-thermosphere region are shown to provide sensitive indications of gravity wave influence. In particular, theoretical predictions of large seasonal and latitudinal variations in the atomic oxygen green line, the Meinal bands of excited OH, and the O3 densities inferred from O2 (delta supra 1 sub g) emission at altitudes from 75 to 90 km are shown to be in remarkably good agreement with observations. Implications of these sensitive chemical tracers for the dynamics of the mesosphere-lower thermosphere region and its relationship to gravity waves are discussed.

Author

N86-27778*# Alaska Univ., Fairbanks. Geophysical Inst.
LOCAL EFFECTS OF GRAVITY WAVE PROPAGATION AND SATURATION
David C. Fritts *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

In recent years, gravity waves were recognized to play a major role in the dynamics of the middle atmosphere. Perhaps the major effect of such motions are the reversal of the vertical shear of the mean zonal wind and the occurrence of a large turbulent diffusivity in the mesosphere due to gravity wave saturation. Yet, despite the importance of these gravity wave effects, the processes and the consequences of gravity wave propagation and saturation are only beginning to be understood in detail. The linear saturation theory predicts drag and turbulent diffusion due to saturating wave motion. This theory, however, fails to address a number of issues that are certain to be important for gravity wave propagation and saturation in the middle atmosphere. These issues, including wave transience, wave superposition, local convective adjustment, and nonlinearity, are discussed. Author

N86-27779*# Illinois Univ., Urbana-Champaign. Dept. of Electrical and Computer Engineering.
THE SPEED OF WAVE-WAVE INTERACTIONS IN THE ATMOSPHERE
K. C. Yeh and C. H. Liu *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
(Grant NSF ATM-83-12175)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Resonant wave-wave interactions are considered. Studies of the interaction coefficient show that rapid transfer of wave action can take place in the disjoined parts of the spectrum for three processes, namely: elastic scattering, parametric subharmonic instability and induced diffusion. Of the three processes, the vertical shear plays a role in two. The vertical shear of a moderate scale interacts through elastic scattering to make the spectrum vertically symmetric. On the other hand, the vertical shear of a large scale interacts through induced diffusion and is responsible for diffusion in k sub z space. When interacting with a vertical shear, it is known that the vertical shear acts as a catalyst and is not involved in energy transfer. Consequently, in both elastic scattering and induced diffusion, the vertical shear does not gain or lose energy. Through parametric subharmonic instability the more energetic large-scale waves are feeding energy into moderate and small scale waves of an elevation angle of 60 deg or larger. E.R.

N86-27780*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A RAY TRACING MODEL OF GRAVITY WAVE PROPAGATION AND BREAKDOWN IN THE MIDDLE ATMOSPHERE
Mark R. Schoeberl *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 1 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Gravity wave ray tracing and wave packet theory is used to parameterize wave breaking in the mesosphere. Rays are tracked by solving the group velocity equations, and the interaction with the basic state is determined by considering the evolution of the packet wave action density. The ray tracing approach has a number of advantages over the steady state parameterization as the effects of gravity wave focussing and refraction, local dissipation, and wave response to rapid changes in the mean flow are more realistically considered; however, if steady state conditions prevail, the method gives identical results. The ray tracing algorithm is tested using both interactive and noninteractive models of the basic state. In the interactive model, gravity wave interaction with the polar night jet on a beta-plane is considered. The algorithm produces realistic polar night jet closure for weak topographic forcing of gravity waves. Planetary scale waves forced by local transfer of wave action into the basic flow in turn transfer their wave action into the zonal mean flow. Highly refracted rays are also found not to contribute greatly to the climatology of the mesosphere, as their wave action is severely reduced by dissipation during their lateral travel. Author

N86-27781*# Adelaide Univ. (Australia). Dept. of Physics.
GRAVITY WAVE MOTIONS AND MOMENTUM FLUXES IN THE MIDDLE ATMOSPHERE AT ADELAIDE, AUSTRALIA
R. A. Vincent and D. C. Fritts (Alaska Univ., Fairbanks) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A study was made of gravity wave momentum fluxes in the middle atmosphere using data collected during June 1984 at Adelaide, Australia (35 deg S). The primary objectives were to identify that portion of the gravity wave spectrum that contributes most of the momentum transport and flux divergence and to examine the temporal variability of wave energies and momentum fluxes. The data were obtained with an HF (2 MHz) radar operated in a Doppler configuration with two coplanar off-vertical beams. This technique provides a direct measure of the vertical flux of horizontal momentum due to an arbitrary spectrum of gravity wave and other motions in the plane of the radar beams. Author

N86-27782*# Academia Sinica, Beijing (China). Institute of Atmospheric Physics.
MAP-ORIENTED RESEARCH IN THE PEOPLE'S REPUBLIC OF CHINA
Daren Lu *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A brief accounting of MAP oriented research in the Republic of China is given. A stratosphere balloon launching facility and its capabilities are reviewed. Observations of the stratospheric aerosols with a balloon-borne aerosol computer were made. Long term monitoring of stratospheric aerosols induced by volcanic eruptions are made with a ruby lidar. The main parameters of an ST radar system are given. The ionospheric D region is investigated with the method of ionospheric absorption. And photochemical modeling and radiation parameterization of the middle atmosphere are made. E.R.

N86-27783*# Kyoto Univ. (Japan). Radio Atmospheric Science Center.
QUANTITATIVE STUDY ON DISPERSION RELATIONS OF TIDs OBSERVED BY AN HF DOPPLER ARRAY
M. Tsutsui and T. Ogawa *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A quantitative study on the dispersion relation of traveling ionospheric disturbances (TIDs) was performed by using data obtained by an HF Doppler array. Observed data at three stations are digitized continuously with a sampling period of 10 sec. A schematic illustration of a running analysis method is given. Fourier components omega's and their wave vectors k's of the TIDs are calculated from these subset data from three stations by means of the cross-spectrum analysis. Diagrams of horizontal trace velocity V sub ph versus wave period T were also obtained. From these diagrams one can see clear cutoff periods of the internal mode

of the atmospheric gravity waves. A morphological classification of the mode of the omega - k and V sub ph - T obtained through one year was performed. The estimation of the horizontal velocity vectors of the thermospheric wind form their dispersion relations was performed also. A key point of the method of obtaining the vectors is to estimate the tilt, in azimuthally different omega - k diagrams, of a resonant branch ascribed to the Brunt oscillations. Author

N86-27784*# Doshisha Univ., Kyoto (Japan). Dept. of Electronics.

HF DOPPLER OBSERVATIONS OF ACOUSTIC WAVES EXCITED BY THE EARTHQUAKE

T. Ichinose, K. Takagi, T. Tanaka (Toshiba Electric Co., Nagoya (Japan), T. Okuzawa (University of Electro-Communications, Tokyo (Japan), T. Shibata, Y. Sato (Tohoku Univ., Sendai (Japan), C. Nagasawa (Tokyo Metropolitan Univ. (Japan).), and T. Ogawa (Kyoto Univ. (Japan) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 310-318 (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Ionospheric disturbances caused by the earthquake of a relatively small and large epicentral distance have been detected by a network of HF-Doppler sounders in central Japan and Kyoto station, respectively. The HF-Doppler data of a small epicentral distance, together with the seismic data, have been used to formulate a mechanism whereby ionospheric disturbances are produced by the Urakawa-Oki earthquake in Japan. Comparison of the dynamic spectra of these data has revealed experimentally that the atmosphere acts as a low-pass filter for upward-propagating acoustic waves. By surveying the earthquakes for which the magnitude M is larger than 6.0, researchers found the ionospheric effect in 16 cases of 82 seismic events. As almost all these effects have occurred in the daytime, it is considered that it may result from the filtering effect of the upward-propagating acoustic waves. Author

N86-27785*# Kyushu Univ., Fukuoka (Japan). Dept. of Physics.

ESTIMATION OF NEUTRAL WIND VELOCITY IN THE IONOSPHERIC HEIGHTS BY HF-DOPPLER TECHNIQUE

T. Kitamura, M. Takefu, and N. Hiroshige *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Three net stations located about 100 kilometers apart were set up around the station of the standard frequency and time signals (JJY) in central Japan and measurements of atmospheric gravity waves in the ionospheric heights (F-region, 200 to 400 km) were made by means of the HF-Doppler technique during the period of February 1983 to December 1983. The frequencies of the signals received are 5.0, 8.0 and 10.0 MHz, but only the 8.0 MHz signals are used for the present study, because no ambiguities due to the interference among other stations such as BPM, BSF, etc. exist by the use of 8.0 MHz. Two main results concerning the horizontal phase velocity of the atmospheric gravity waves with periods of 40 to 70 min may be summarized as follows: (1) the value of the phase velocity ranges from 50 m/s to 300 m/s; (2) the direction of the gravity wave propagation shows a definite seasonal variation. The prevailing direction of the gravity waves in winter is from north to south, which is consistent with the results obtained from other investigations. On the other hand, the two directions, from northeast to southwest and from southeast to northeast, dominate in summer. Author

N86-27786*# Calgary Univ. (Alberta). Dept. of Physics.

SATELLITE OBSERVATIONS OF 557.7 NM AIRGLOW AS A DIAGNOSTIC TECHNIQUE TO STUDY THE DYNAMICS OF THE LOWER THERMOSPHERE

L. L. Cogger, R. Elphinstone, and J. S. Murphree *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 1 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Photometric observations of the airglow limb at 557.7 nm have been made from the ISIS 2 satellite since 1971. From an analysis of 32,000 airglow limb observations obtained during the first two years of operation, the major temporal and spatial characteristics of the night airglow have been identified. Maxima occur in mid-October and mid-April at all latitudes. There is a marked variation with latitude during the equinox periods, with peak intensities near 35 degrees in autumn and near 25 degrees in spring. It is possible to gain considerable insight into the behavior of the lower thermosphere by combining the airglow observations with a simple model of the photochemical and dynamical processes. In this way a pattern of the latitude and temporal variation of atomic oxygen concentration at the peak of the layer as well as the eddy diffusion in this altitude region have been inferred. The concentration of atomic oxygen shows midlatitude peaks near equinox, and minima about one month after solstice. Average values at midlatitudes are about 1.3 times those at the equator. The amplitude of the semiannual component is about 20% of the mean value at 35 degrees as compared to 10% at the equator, and the amplitude of 12-month component is about 12% at 35 deg and 5% at the equator. The semiannual component has a minimum that occurs approximately 3 weeks (plus or minus) after solstice at all latitudes, while the 12-month component peaks in the summer hemisphere at solstice (plus or minus 2 months). Author

N86-27787*# Radio Research Labs., Tokyo (Japan).

LOCAL TIME DISTRIBUTION OF THE SSC-ASSOCIATED HF-DOPPLER FREQUENCY SHIFTS

T. Kikuchi, H. Sugiuchi, and T. Ishimine *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 1 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The HF-Doppler frequency shift observed at the storm's sudden commencement is composed of a frequency increase (+) and decrease (-), and classified into four types, SCF(+ -), SCF(- +), SCF(+) and SCF(-). Since the latter two types are special cases of the former two types, two different kinds of electrical field exist in the F region and cause the ExB drift motion of plasma. HUANG (1976) interpreted the frequency increase of SCF(+ -) as due to the westward induction electric field proportional to delta H/ delta t and the succeeding frequency decrease due to the eastward conduction electric field which produces ionospheric currents responsible for the magnetic increase on the ground. In spite of his success in interpreting the SCF(+ -), some other interpretations are needed for the explanation of the whole set of SCF's, particularly SCF(- +). Local time distributions of the SCF's are derived from 41 SCF's which are observed on the HF standard signal (JJY) as received in Okinawa (path length =1600 km) and Kokubunji (60 km). It is shown that the SCF(+ -) appears mainly during the day, whereas the SCF(- +) is observed during the night. The results indicate that the preliminary frequency shift (+) of SCF(+ -) and (-) of SCF(- +) is caused by a westward electric field in the dayside hemisphere, while by an eastward electric field in the nightside hemisphere. The main frequency shift [(-) of SCF(+ -) and (+) of SCF(- +)] is caused by the reversed electric field. Consequently, the preliminary frequency shift is caused by the dusk-to-dawn electric field, while the main frequency shift by the dawn-to-dusk electric field. Author

N86-27788*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

TRANSPORT PROCESSES AS MANIFESTED IN SATELLITE AND LIDAR AEROSOL MEASUREMENTS

M. P. McCormick *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 1 p (For primary document

see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A large increase in stratospheric aerosol data has become available recently from the SAM II and SAGE satellite sensors and the impetus from increased volcanic perturbations. Six years of SAM II and nearly 3 years of SAGE measurements have been accumulated. The increase in large volcanic eruptions since 1979 has caused an acceleration of new data sets from worldwide lidars and airborne lidar campaigns and from various airborne in situ measurements. The SAM II and SAGE data sets show the tropical stratosphere as a source for background stratospheric aerosols, and midlatitudes as a possible sink. Analyses of SAM II data show that the aerosol within the northern wintertime polar vortex becomes isolated from the outside. Subsidence occurs within the vortex, changing the vertical aerosol distribution over the winter period. SAM II and SAGE data show that the aerosol is transported in the stratosphere from low to high latitudes in wintertime. Entry regions of tropospheric air in the Tropics are also evident in the SAGE data as shown by stratospheric cirrus clouds being formed well above the local tropopause. Nature has provided over the past 5 years a number of large volcanic eruptions which spewed tons of new aerosol into the stratosphere. These eruptions have occurred at various latitudes which allow transport differences to be studied. Satellite and lidar aerosol data will be used to describe the stratospheric motions of aerosols produced after these violet volcanic eruptions. Author

N86-27789*# Meteorological Research Inst., Tsukuba (Japan).
RUBY LIDAR OBSERVATIONS AND TRAJECTORY ANALYSIS OF STRATOSPHERIC AEROSOLS INJECTED BY THE VOLCANIC ERUPTIONS OF EL CHICHON
O. Uchino, T. Tabata, I. Akita, Y. Okada, and K. Naito *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 7 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Large amounts of aerosol particles and gases were injected into the lower stratosphere by the violet volcanic eruptions of El Chichon on March 28, and April 3 and 4, 1982. Observational results obtained by a ruby lidar at Tsukuba (36.1 deg N, 140.1 deg E) are shown, and some points of latitude dispersion processes of aerosols are discussed. Author

N86-27790*# Kyushu Univ., Fukuoka (Japan). Dept. of Physics.
LIDAR OBSERVATIONS OF THE EL CHICHON CLOUD IN THE STRATOSPHERE OVER FUKUOKA
M. Fujiwara, T. Shibata, and M. Hirono *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A volcanic cloud in the stratosphere, originating from the March to April 1982 eruptions of El Chichon, has been observed for about 2.5 years at Fukuoka (33.5 degrees N, 130.4 degrees E) with two wavelengths of Nd-YAG lidar, 1.06 and 0.53 microns. Time and height variabilities of the cloud are described, using the 1.06 microns data, and some results of the two-wavelength measurements are presented. A sudden enormous increase in the total aerosol backscattering from the stratosphere (backscattering coefficient for 1.06 microns integrated over 13.5 to 28.5 km range) was followed by a decrease from late spring to summer with large fluctuations. The cloud initially appeared stratified into two layers: the upper one with fine structure and sharp edges in the easterly wind region and the lower dumpy one in the westerly wind region. Most of the aerosols were contained in the upper layer. The two layers merged into a broad, single-peaked layer as the easterly prevailed in the whole region in fall, when the total aerosol backscattering began to increase. The layer then decreased its peak height as it broadened. The difference in shape of both layers and the increase of total backscattering from fall can be interpreted by the difference in velocity of material transport in the easterly and the westerly wind region. Author

N86-27791*# Nagoya Univ. (Japan). Water Research Inst.
ON THE LONG TERM VARIATION OF STRATOSPHERIC AEROSOL CONTENT AFTER THE ERUPTION OF VOLCANO EL CHICHON: LASER RADAR MEASUREMENTS
S. Hayashida and Y. Iwasaka *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The results of measurements of the stratospheric aerosol layer by a ruby lidar (lambda = 0.6943 microns) for two years after the eruption of El Chichon (March 29, April 4, 1982, Mexico) are given. The results show the sudden increase in the stratospheric aerosol content after the eruption and its subsequent decline. Author

N86-27792*# Nagoya Univ., Toyokawa (Japan). Research Inst. of Atmospherics.
BEHAVIOR OF DECAYING EL CHICHON CLOUD OVER TOYOKAWA, JAPAN (35 DEG N) OBSERVED BY 532-NM LIDAR
M. Takagi, A. Iwata, and Y. Kondo *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The stratospheric aerosol state in 1982 and 1983 was in a violet excitation due to the eruption of Mt. El Chichon. A number of direct and indirect soundings of the stratosphere confirmed that the aftereffect of it covered almost the entire Northern Hemisphere by the end of 1982 (e.g., POLLACK et al., 1983). The lidar system constructed at Toyokawa (34.8 deg N, 137.4 deg E) have entered routine base observations since December 1982 (IWATA et al., 1983). The state of observations was 8 months after the eruption, and researchers missed monitoring the drastic variations in the stratosphere just following the event. However, the El Chichon cloud over Japan was reported to have reached the second maximum concentration in November or December 1982 according to the lidar observations at Tsukuba, Nagoya and Fukuoka, so the researchers' observations corresponded to the decaying phase of it. Presented are some characteristics of the aerosol profile over Toyokawa during a period of 20 months from December 1982 to July 1984. Author

N86-27793*# Kyushu Univ., Fukuoka (Japan). Dept. of Physics.
COMPARATIVE STUDY OF AEROSOLS OBSERVED BY YAG LIDAR AND AIRBORNE DETECTORS
M. Hirono, M. Fujiwara, and T. Shibata *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The causal relationships of very large (tropical) volcanic eruptions and El Nino Southern Oscillations (ENSO) based on the unequal atmospheric heating by aerosols observed by lidar and airborne detectors are discussed. Author

N86-27794*# Kyushu Univ., Fukuoka (Japan). Dept. of Electrical Engineering.
EXICIMER LIDAR MEASUREMENTS OF OZONE
T. Shibata, O. Uchino (Meteorological Research Inst., Tsukuba (Japan), and M. Maeda *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP

Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The observation of the atmospheric ozone profile in an altitude range of 3 to 28 km by means of differential absorption lidar in combination with an XeCl laser (308 nm) and SRS pumped by a KrF laser (249 nm) is discussed. Author

N86-27795*# Department of Energy, New York. Environmental Measurements Lab.

MEASUREMENTS OF CCl3F, CCl2F2, CCl4, N2O AND SF6 IN THE NORTHERN HEMISPHERE STRATOSPHERE

Robert Leifer and Russell Juzdan *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

An overview of the Department of Energy's High Altitude Sampling Program and some recent trace gas measurement results are presented. Analysis of whole air samples, collected in pressurized bottles, provides information on stratospheric inventories and distributions for CCl3F, CCl2F2, CCl4, N2O and SF6 in the Northern Hemisphere. Based on a linear regression analysis of the data the estimated mean Northern Hemisphere stratospheric concentration of each gas increased as follows: CCl3F changed from 54 to 142 p1/1 (4/74-11/83); CCl2F2 changed from 133 to 268 p1/1 (4/76-11/83); SF6 changed from 160 to 480 f1/1 (4/74-11/83); CC1, changed from 58 to 91 p1/1 (4/75-11/83); N2O changed from 246 to 261 n1/1 (4/76-11/83). The calculated mean Northern Hemisphere stratospheric concentrations of N2O, CCl3F, CCl2F2, and CCl4 after 1980 show larger than expected fluctuations with time. Recent volcanic activity may be a partial cause for these fluctuations through induced changes in stratospheric dynamical processes. Author

N86-27796*# National Center for Atmospheric Research, Boulder, Colo.

TRANSPORT OF TRACE SPECIES DEDUCED FROM LIMS OBSERVATIONS

J. C. Gille, L. V. Lyjak, A. K. Smith, P. L. Bailey, S. T. Massie, and C. M. Smythe *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)

(NASA Order L-9469-B; NASA Order W-15439)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

One of the critical problems in the middle atmosphere at this time is understanding the interaction between atmospheric motions and photochemistry, and the way in which these two processes maintain the distributions of photochemically active species such as ozone. Recent work has shown that a great deal can be learned by considering the zonally averaged distributions and transports, i.e., working in the latitude-altitude plane. This 2-dimensional approach has been used in the past in Eulerian formation. Recent work (DUNKERTON, 1978) has shown that formulating the transport problems in terms of the residual mean circulation, which has similarity to the Lagrangian mean motion, results in a more physical picture of the way in which the transport takes place. Here, data from the Limb Infrared Monitor of the Stratosphere (LIMB) experiment are used to investigate how well the residual mean formulation works with real data, in the sense of asking how well the predicted ozone changes match those in regions of the lower stratosphere in which chemical changes may be neglected. This allows a test of the approximations that are made, and of the strengths and weaknesses of this approach to transport calculation. Author

N86-27797*# Tokyo Univ. (Japan). Institute of Space and Astronautical Science.

LIMB-ATMOSPHERIC INFRARED SPECTRUM OBSERVED ON THE SATELLITE OHZORA

A. Matsuzaki, Y. Nakamura, and T. Itoh *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 1 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The Institute of Space and Astronautical Science (ISAS) launched the 9th scientific satellite Ohzora at 17:00 JST on February 14, 1984. This satellite bears the spectrometer, which measures the infrared spectrum of the solar radiation passing the limb atmosphere in the wavelength region of 2 to 10 m. The spectrometer is based on multichannel spectroscopy by using image sensors. Since the wavelength is scanned electronically, it can measure the spectrum unaffected by the satellite motion. A definite axis, i.e., the Z-axis of the satellite, which coincides to the optical axis of the spectrometer, is controlled to the direction of the Sun, and the finer control to introduce the solar light into the spectrometer is made with a 2-axes-controlled mirror. This solar tracking equipment is derived fast enough to measure the spectra in a moment after sunrise. The solar light introduced into the spectrometer is focused on the slits of the monochromators (f=100mm). For better altitude resolution, the horizontal slit is also used with the vertical slit, which is used for the separation of the dispersion. The dispersion light is detected with the pyroelectric array sensors. To obtain maximum dynamic range and spectral resolution, the three-stage polychromator is used. Author

N86-27798*# Tokyo Univ. (Japan). Dept. of Chemistry.

ATMOSPHERIC CONCENTRATIONS AND BEHAVIOR OF HALOCARBONS AND METHANE

Y. Makide, A. Yokohata, and T. Tominaga *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 1 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The atmospheric concentrations of halocarbons and methane in the troposphere and stratosphere were precisely measured by grab-sampling followed by gas-chromatographic analysis in the laboratory. Chlorofluorocarbons such as CCl2F2 and CCl3F have received a great deal of attention due to their probable impact on the stratospheric ozone: the chlorofluorocarbons accumulated in the troposphere are eventually decomposed by photolysis in the stratosphere releasing Cl radicals which in turn participate in the ClO sub x-catalytic chain destroying the ozone, especially in the upper stratosphere. Methane reacts with Cl in the stratosphere reducing the ozone depletion, while its source and future trend of concentration in the troposphere are uncertain. The study of their distribution and behavior in the atmosphere are therefore very important. After the extensive survey of the locations for collection of atmospheriic samples representing the midlatitudes Northern Hemisphere (N.H.) without local contamination, we have measured the concentrations of CCl2F2, CCl3F, CH3CCl3, CC1, CHCl=CCl2 and CCl2=CCl2 with plus or minus 1 pptv precision in samples collected in Hokkaido and west coast Tohoku area (the northern part of Japan, 40 deg to 45 deg N) every summer and winter since 1979. The observed concentrations of CCl2F2 and CCl3F are now above 360 and 200 pptv, respectively, and have been steadily increasing by approx. 15 and approx. 8 pptv/year during the last several years. Author

N86-27799*# Meteorological Research Inst., Tsukuba (Japan).

TRANSPORT CHARACTERISTICS IN THE MIDDLE ATMOSPHERE AND TWO-DIMENSIONAL MODELING

Hideji Kida *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 8 p (For primary document see N86-27719 18-46)

Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Transport mechanisms of tracers in the atmosphere are briefly discussed from a viewpoint of Lagrangian motions of air parcels. The tracers are retained by air parcels themselves. In this regard, both momentum and energy are quite different from chemical

tracers. The present problem is what interpretation is best for understanding transport mechanisms of tracers. A method is reviewed and proposed, although conceptually. The numerical model used was a whole hemispheric global climate model. Annual- and zonal-mean diabatic forcing was assumed to drive the general circulation. Time integrations were carried out for about 100 days. The model quasi-equilibrium states were analyzed.
Author

N86-27800*# Commonwealth Scientific and Industrial Research Organization, Mordialoc (Australia). Div. of Atmospheric Research.
THE ZONALLY AVERAGED TRANSPORT CHARACTERISTICS OF THE ATMOSPHERE AS DETERMINED BY A GENERAL CIRCULATION MODEL
R. Alan Plumb *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 2 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Two dimensional modeling has become an established technique for the simulation of the global structure of trace constituents. Such models are simpler to formulate and cheaper to operate than three dimensional general circulation models, while avoiding some of the gross simplifications of one dimensional models. Nevertheless, the parameterization of eddy fluxes required in a 2-D model is not a trivial problem. This fact has apparently led some to interpret the shortcomings of existing 2-D models as indicating that the parameterization procedure is wrong in principle. There are grounds to believe that these shortcomings result primarily from incorrect implementations of the predictions of eddy transport theory and that a properly based parameterization may provide a good basis for atmospheric modeling. The existence of these GCM-derived coefficients affords an unprecedented opportunity to test the validity of the flux-gradient parameterization. To this end, a zonally averaged (2-D) model was developed, using these coefficients in the transport parameterization. Results from this model for a number of contrived tracer experiments were compared with the parent GCM. The generally good agreement substantially validates the flus-gradient parameterization, and thus the basic principle of 2-D modeling.
Author

N86-27801*# Kyoto Univ. (Japan). Geophysical Inst.
DYNAMICAL ROLES OF PLANETARY WAVES ON THE WINTER ANOMALY IN THE MIDDLE AND LOWER LATITUDES
Kohji Kawahira *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 6 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The winter anomaly of radio wave absorption in the ionospheric D region (65 to 90 km), caused by a factor of about ten increase in electron density, has been considered to be due to a factor of about ten increase of the nitric oxide concentration and/or a few tens of degrees Kelvin temperature rise due to a strong temperature dependency of the conversion rate of molecular ions to cluster ions. In order to investigate the mechanism of the winter anomaly, the processes that brought about these changes are identified. It is well known that stratospheric warmings sometimes accompany the winter anomaly in middle latitudes. The present study concentrates on the winter anomaly which occurred simultaneously during a sudden warming of the 1967 to 1968 winter, from middle December 1967 to middle January 1968. Variations of geophysical and ionospheric parameters are shown.
Author

N86-27802*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRANSPORT PROCESSES IN THE STRATOSPHERE: MODEL SIMULATIONS AND COMPARISONS WITH SATELLITE OBSERVATIONS
W. L. Grose, R. E. Turner, and J. E. Nealy *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

A three dimensional atmospheric model was used to study transport processes and to simulate the distribution of chemically active species in the stratosphere. The present results are part of a long term simulation of the seasonally varying structure of stratospheric trace constituents. The occurrence of a midwinter stratospheric warming and the associated transport of O3 and HNO3 during the simulation are described. Comparison of the simulated distributions of O3 and HNO3 are made with data from the Limb Infrared Monitor of the Stratosphere (LIMS) experiment. In addition, distributions of Ertel's potential vorticity on isentropic surfaces (IPV) are evaluated as a diagnostic for interpreting transport processes. Comparisons are made with IPV distributions inferred from LIMS temperature data.
Author

N86-27803*# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie.
OZONE DURING SUDDEN STRATOSPHERIC WARMING: A THREE-DIMENSIONAL SIMULATION
K. Rose and G. Brasseur (Institut d'Aeronomie Spatiale de Belgique, Brussels.) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Sudden warmings which are currently observed in the winter stratosphere are believed to be due to the upward propagation of planetary waves originating in the troposphere. Major warmings are characterized by local increases of the temperature in a deep layer beyond the stratopause, with values of the order of 50 K at 10 mbar appearing over a short period of time and leading to significant changes in the rate constant of several chemical reactions. During such events, the dynamical fields in the stratosphere are completely altered, so that dramatic changes in the transport of trace constituents are expected. Preliminary results of a 3-D model simulation of the ozone behavior during winter in connection with the appearance of stratospheric warmings are reported. The middle stratosphere (12 mbar or approximately 32 km) where the chemical lifetime of odd oxygen is quite long, and consequently, transport plays a major role is emphasized.
Author

N86-27804*# Meteorological Research Inst., Tsukuba (Japan).
INTRUSION PROCESS OF STRATOSPHERIC OZONE INTO THE TROPOSPHERE OVER JAPAN
H. Muramatsu, Y. Makino, M. Hirota, and T. Sasaki *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The stratospheric-tropospheric exchanges play an important role in determining the distribution and residence time of ozone, aerosol and other substances in the stratosphere and troposphere. The ozone transport is estimated from the stratosphere into the troposphere by so-called tropopause folding event associated with the polar front jet stream. It is shown that in winter ozone transport occurs mainly in the region to the north of Japan in Asia. The ozone transport rate is estimated. Vertical velocity was estimated by marking the air parcel of an observation aircraft and tracking is on the isentropic surface.
Author

N86-27805*# Kyoto Univ. (Japan). Lab. for Climatic Change Research.
AN INTERPRETATION FOR THE INTERANNUAL VARIATIONS OF THE GLOBAL DISTRIBUTION OF TOTAL OZONE
Fumio Hasebe *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document

see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The quasibiennial oscillation (QBO) and the four year oscillation (FYO) in total ozone are discussed. In order to understand these oscillations, a comprehensive view of the ozone and the stratospheric temperature is attempted. The standpoint here is to examine if these oscillations could be understood as a reflection of the general circulation changes in the stratosphere. The description of the circulation is based on the Lagrangian-mean point of view, although only a rough estimate is obtained. For the sake of simplicity, the ozone is assumed to be an inert tracer following the atmospheric motion. Author

N86-27806*# Calcutta Univ. (India). Inst. of Radiophysics and Electronics.
EMISSION, ABSORPTION AND GROUP DELAY OF MICROWAVES IN THE ATMOSPHERE IN RELATION TO WATER VAPOUR CONTENT OVER THE INDIAN SUBCONTINENT
A. K. Sen, A. K. Dev Gupta (Scottish Church Coll., Calcutta, India), P. K. Karmakar (Saint Andrew's High School, Calcutta, India), S. Dev Barman (Bajkul Milani Coll., West Bengal, India), A. B. Bhattacharya (Serampore Coll., West Bengal, India), N. Purkait, M. K. Das Gupta, and J. S. Sehra (Department of Electronics, New Delhi, India) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 399-404 (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The advent of satellite communication for global coverage has apparently indicated a renewed interest in the studies of radio wave propagation through the atmosphere, in the VHF, UHF and microwave bands. The extensive measurements of atmosphere constituents, dynamics and radio meterological parameters during the Middle Atmosphere Program (MAP) have opened up further the possibilities of studying tropospheric radio wave propagation parameters, relevant to Earth/space link design. The three basic parameters of significance to radio propagation are thermal emission, absorption and group delay of the atmosphere, all of which are controlled largely by the water vapor content in the atmosphere, particular at microwave bands. As good emitters are also good absorbers, the atmospheric emission as well as the absorption attains a maximum at the frequency of 22.235 GHz, which is the peak of the water vapor line. The group delay is practically independent of frequency in the VHF, UHF and microwave bands. However, all three parameters exhibit a similar seasonal dependence originating presumably from the seasonal dependence of the water vapor content. Some of the interesting results obtained from analyses of radiosonde data over the Indian subcontinent collected by the India Meteorological Department is presented. Author

N86-27807*# Kyushu Univ., Fukuoka (Japan). Dept. of Electrical Engineering.
NUMERICAL SIMULATION OF EL CHICHON VOLCANIC CLOUD
T. Shibata, M. Fujiwara, and M. Hirono *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 2 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The stratospheric volcanic cloud from the eruption of El Chichon, Mexico, on April 4, 1982 was observed routinely by a Nd:YAG lidar system from April 18, 1982 at Kyushu University. There were two phenomena detected by lidar observation of the El Chichon volcanic cloud: (1) The main enhanced layer was formed in the summer easterly wind region over Fukuoka (33.5 deg N, 130.4 deg E). The layer had two high gradient top and bottom boundaries. The layer width slowly broadened until September 1982, when the easterly wind changed to the westerly wind. A similar phenomenon was observed after the eruption of Mt. St. Helens in May 1980. (2) The stratospheric integrated backscattering coefficient (IBC) reached a peak value on May 3, 1982. It then gradually decreased until August, but reincreased significantly from September to December 1982. After January 1983, IBC decreased slowly. This remarkable reincrease had not been seen in past increases which had been observed by lidar at Kyushu University. These phenomena are briefly discussed. Author

N86-27808*# Kyoto Univ. (Japan). Geophysical Inst.
A NEGATIVE ION MODEL IN THE LOWER STRATOSPHERE
Hiroto Kawamoto and Toshio Ogawa *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

There are a number of problems in the electricity of the stratosphere at middle latitudes; e.g., the positive relation between the seasonal variations of negative polar conductivity and that of ozone density, the observed dependence of the daytime variation of conductivity on the solar zenith angle, and the interaction between the ions and aerosols, particularly the processes of the conversion from negative ions to the sulfate aerosols; e.g., ion-nucleation and the growth through multi-ion complexes. As a basic tool for investigating these problems, a negative ion chemical model was constructed in the altitude region of 15 to 30 km. Recently, the success of in situ mass analysis of stratospheric ions has revealed the nature of the most abundant ions in the stratosphere. Further, the height variations of negative ion composition between 15 and 34 km were obtained with the balloon-borne mass spectrometer by another researcher. A comparison of the calculated result with the observed result is given. Author

N86-27809*# Nagoya Univ., Toyokawa (Japan). Research Inst. of Atmospherics.
AIRCRAFT MEASUREMENTS OF AEROSOLS IN THE UPPER TROPOSPHERE AT MIDLATITUDES
Y. Morita, M. Takagi, and Y. Kondo *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Aircraft measurements of aerosols were made during the years 1982 to 1984 in the upper troposphere. In some cases, the influence of the local atmospheric pollution originating from the land surface was observed. The background concentration of the Mie particle was about 0.1/cu. cm. at an altitude of 6 to 8 km. An air mass of stratospheric origin was observed over the Japan sea in the winters of 1983 and 1984. The Mie particle concentration increased and the count ratio of two size ranges was found to be a large value in 1983, the value decreased to that of a background level in the stratosphere in 1984. The volcanic eruption of Mt. El Chichon seems to be responsible for the large aerosol count ratio of the measurements of 1983. Author

N86-27810*# Kyushu Univ., Fukuoka (Japan). Dept. of Physics.
LIDAR OBSERVATIONS OF THE NIGHTTIME SODIUM LAYER AT 33 DEG N
Michihiro Uchiumi, Motokazu Hirono, and Motowo Fujiwara *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Measurements of the nighttime atmospheric sodium layer have been performed since 1977, using a dye lidar at Fukuoka (33.4 deg N, 130.2 deg E.). The Kyushu lidar uses a flashlamp pumped dye laser tuned to the sodium D sub 2 line (589.0 nm)

as a transmitter. The dye laser used in the Kyushu lidar system has been described elsewhere. Sporadic enhancements of the total column abundance of the layer during the Perseids meteor shower were observed on the nights of August 12 and 13, 1978, 1979, 1981, and 1983. Degrading weather conditions prevented observation on the nights during 1980 and 1983. A contour plot of the sodium layer for the period of 8 hours from 21:00 to 5:00 JST on the night of August 12 to 13 1983, is shown. The predominant feature visible is the increase in the height of peak density from 21:00 to 2:00 JST, and the slight decrease in the height of peak density from 2:00 to 5:00 JST. The average abundance had a maximum of about 7 x 10 to the 13th power/sq m on August 13. A plot is presented of the nightly average abundance for available data. The sodium layer abundance increased on the night of August 12 to 13, 1983, during the peak of the Perseids meteor shower, and the following night, August 13 to 14, almost went back to the monthly mean. Author

N86-27811*# Mysore Univ. (India). Dept. of Physics.
ION LOSS PROCESSES IN THE STRATOSPHERE
B. S. N. Prasad and S. Chandramma *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Small ions consisting of aggregates of a few molecules determine th stratospheric electrical parameters such as conductivity, mobility, etc. The small ion density is controlled by the ionizing mechanisms for the production of ions and electrons and the loss processes for these charged particles. Ion production in stratosphere is chiefly due to galactic cosmic rays, and the loss processes due to recombination and attachment. Free electrons do not exist at stratospheric heights. The primary positive ion O2+ and the electrons are converted into complex clusters of positive and negative ions. The equilibrium ion density is governed by the equation of continuity for the production and loss of these ions. In the generalized equation of continuity, the gain or loss of ions due to transport is neglected. When aerosols or particulates are not present in the atmosphere, ions are loss due to ion-ion recombination. In the presence of aerosols, small ions can also be lost by attachment to the aerosols, and thus aerosols are likely to cause perturbations in the stratosphere electrification. A simplified model approach is adopted to study the effect of aerosols on the equilibrium ion density. The results of the analysis for the equatorial station Thumba (8.5 deg N) are presented. Author

N86-27812*# Institut d'Aeronomie Spatiale de Belgique, Brussels.
VERTICAL DISTRIBUTION OF ACETONITRILE IN THE ATMOSPHERE
J. Ingels, D. Nevejans, and E. Arijs *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p Original language document was announced as N86-22021 (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The presence of acetonitrile in the atmosphere was confirmed by results of surface and stratospheric investigations. Stratospheric measurements give mixing ratios typically decreasing with height from 3 ppt at 25 km to 0.5 ppt at 40 km. Measurements at the Earth's surface are less unanimous, although a ground level background mixing ratio of a few times 10 ppt seems realistic. Measurements are compatible with a small global surface source of acetonitrile and a small tropospheric loss. The vertical distribution of acetonitrile presented in consistent with general knowledge of its atmospheric chemistry. Author (ESA)

N86-27813*# Tokyo Univ. (Japan). Inst. of Space and Astronautical Science.
MEASUREMENTS OF CONCENTRATIONS OF CHLOROFLUOROMETHANES (CFMs) CARBON DIOXIDE AND CARBON ISOTOPE RATIO IN STRATOSPHERIC AND TROPOSPHERIC AIR BY GRAB-SAMPLING SYSTEMS
T. Itoh, H. Kubo, H. Honda, T. Tominaga, Y. Makide, A. Yakohata, and H. Sakai *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 7 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Measurements of concentrations of chlorofluoromethanes (CFMs), carbon dioxide and carbon isotope ratio in stratospheric and tropospheric air by grab-sampling systems are reported. The balloon-borne grab-sampling system has been launched from Sanriku Balloon Center three times since 1981. It consists of: (1) six sampling cylinders, (2) eight motor driven values, (3) control and monitor circuits, and (4) pressurized housing. Particular consideration is paid to the problem of contamination. Strict requirements are placed on the choice of materials and components, construction methods, cleaning techniques, vacuum integrity, and sampling procedures. An aluminum pressurized housing and a 4-m long inlet line are employed to prevent the sampling air from contamination by outgassing of sampling and control devices. The sampling is performed during the descent of the system. Vertical profiles of mixing ratios of CF2Cl2, CFCl3 and CH4 are given. Mixing ratios of CF2Cl2 and CFCl3 in the stratosphere do not show the discernible effect of the increase of those in the ground level background, and decrease with altitude. Decreasing rate of CFCl3 is larger than that of CF2Cl2. CH4 mixing ratio, on the other hand, shows diffusive equilibrium, as the photodissociation cross section of CH4 is small and concentrations of OH radical and 0(sup I D) are low. Author

N86-27814*# Meteorological Research Inst., Tsukuba (Japan).
UV LIDAR MEASUREMENTS OF THE STRATOSPHERIC AEROSOL LAYER AND COMPARISON WITH OTHER OPTICAL DATA
O. Uchino *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

After the violent volcanic eruptions of El Chichon in Mexico (17.33 deg. N, 93.20 deg. W) in late March and early April 1982, enhanced stratospheric aerosols have been monitored by ruby (lasing wavelength lambda=694.3 nm) or Nd:YAG lidars (lambda=1064 or 532 nm). By these lidars, visible or near-infrared optical informations of stratospheric aerosols and their space-time variations can be obtained. It is usually difficult to measure the background level of stratospheric aerosols by an ultraviolet (UV) lidar, since Rayleigh scattering prevails over Mie scattering in the stratosphere. However, after the large volcanic eruptions, UV lidar measurements of stratospheric aerosols are possible. In order to obtain UV optical properties of stratospheric aerosols, measurements have been made at Fukuoka (33.65 deg. N, 130.35 deg. E) by a p-terphenyl dye laser at a wavelength of 340.5 nm. Observational results during October 1982, through May 1983, are shown and are compared with the results obtained by a ruby lidar at Tsukuba (36.05 deg. N, 140.13 deg. E). Author

N86-27815*# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
BALLOON-BORNE OBSERVATIONS OF STRATOSPHERIC AEROSOL IN ANTARCTICA FROM 1972 TO 1984
D. J. Hofmann *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 7 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Stratospheric levels of particles with r > or = 0.15 microns were monitored with optical particle counters in approximately monthly balloon soundings at Laramie, Wyoming (41 deg N) since 1971. These measurements were used to characterize the

background stratospheric aerosol layer and the disturbed layer following major volcanic eruptions. Levels of particles with r > or = 0.01 microns have also been measured with balloon-borne counters since 1973. The latter are collectively called condensation nuclei (CN) as they are characteristic of aerosol in the early stages of growth. While they dominate the size distribution in the tropsophere, they are a trace species in the undisturbed stratosphere. From 1972 until 1980, annual balloon soundings from McMurdo Station (78 deg S) and/or Amundsen-Scott Station (90 deg S), in Antarctica, have also been conducted to crudely monitor Southern Hemisphere aerosol levels. These measurements were continued in 1983 and 1984. Profiles of r > 0.15 microns aerosol concentrations as measured during January at the south pole from 1972 to 1975 and in 1980 are given. The former are typical of undisturbed conditions and indicate the small degree of variability under these conditions. The latter indicates the effect of minor volcanic activity, visible in the 10 to 15 km region. Author

N86-27816*# Nagoya Univ. (Japan). Water Research Inst.
LASER RADAR OBSERVATION OF THE POLAR STRATOSPHERIC AEROSOL LAYER
Y. Iwasaka, T. Hirasawa (National Inst. of Polar Research, Tokyo, Japan), H. Fukunishi, M. Fujiwara (Kyushu Univ., Fukuoka, Japan), R. Fujii (National Inst. of Polar Research, Tokyo, Japan), and H. Miyaoka *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The polar stratosphere has been speculated to be an active sink region of various stratospheric materials; ozone, water vapor, NOX, aerosol particles and so on, but this process is not theoretically and/or observationally made clear. The observation of the polar stratospheric aerosol layer using laser radar certainly contributes to the study of the global transport of these stratospheric minor constituents. In addition to this, from the viewpoint of aerosol science, there may be many interesting phenomena which cannot be found in the stratosphere at mid and low latitudes; the effect of precipitation of high energy molecules and atoms, of very cold winter stratosphere, of very cold mesopause in summer. Laser radar observation is one of the main activities of the Antarctic Middle Atmosphere (AMA) project at Syowa Station (69.00 deg S, 39.35 deg E), Antarctica since May 1983. Laser radar measurement at Syowa Station is discussed in detail. Author

N86-27817*# Meteorological Research Inst., Tsukuba (Japan).
A SPECIAL OZONE OBSERVATION AT SYOWA STATION, ANTARCTICA FROM FEBRUARY 1982 TO JANUARY 1983
Shigeru Chubachi *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The behavior of stratospheric ozone at high latitudes is especially interesting, since the stratospheric ozone at high latitudes is thought to be transported from low latitudes through dynamical processes. However, only limited information has so far been obtained, because ozone observations at high latitudes are sparse. There are only two ozone observation stations operating in Antarctica: Syowa Station and Amundsen-Scott, where the total ozone has been observed in sunlit months only. To make up for this deficiency, extensive observations were carried out at Syowa Station as part of MAP. Some preliminary results of these observations are described. Author

N86-27818*# Meteorological Research Inst., Tsukuba (Japan).
OBSERVATION OF ATMOSPHERIC MINOR CONSTITUENTS BY FTIR AT SYOWA STATION, ANTARCTICA
Y. Makino, H. Muramatsu, S. Kawaguchi (National Inst. of Polar Research, Tokyo, Japan), T. Yamanouchi, M. Tanaka (Tohoku Univ., Sendai, Japan), and T. Ogawa (Tokyo Univ., Japan) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

As a part of the Antarctic MAP activity, a ground-based spectroscopic observation of atmospheric infrared transmission was started at Syowa station (69 deg 00'S, 39 deg 35'E) in March 24, 1983. Observations of sunlight as a radiation source were made with a Fourier transform infrared spectrometer having a maximum path difference of 80 mm and an apodized FWHM resolution of approx. 0.12/cm. In routine operation through the year, the resolution of approx. 0.8/cm was applied for economy of data-processing time. The 408 spectra for 72 days were obtained in about 10 months until January 23, 1984. From the absorption features revealed in the spectra over the wave number range of 500 to 7500/cm, a preliminary estimate of N202 gamma sub 1 band absorption was attempted. An apparent transmittance was defined at the wave number 2576/cm, where the absorption by N20 molecules affected the observed intensity strongly. A ray-tracing technique and a line-by-line calculation with a model atmosphere and the AFGL atmospheric absorption line parameters compilation were applied to the calculation of the synthetic spectra. Author

N86-27819*# Tokyo Univ. (Japan). Geophysics Research Lab.
MEASUREMENT OF POLAR STRATOSPHERIC NO2 FROM THE 23RD AND 24TH JAPANESE ANTARCTIC RESEARCH EXPEDITION (JARE) BALLOON EXPERIMENTS
K. Shibasaki, N. Iwagami, and T. Ogawa *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

As a part of the Japanese activities of MAP in the Antarctica, balloon-borne measurements of the stratospheric NO2 profile were planned and carried out by the JARE 23rd and 24th wintering parties. Few results have been reported so far as the stratospheric NO2 profile at high latitude. There were no reported balloon measurements carried out in the Southern Hemisphere. Profiles are presented for the first balloon-borne measurement of the stratospheric NO2 in the Antarctica. Three balloons named JA21, JA25 and JA26 were launched from Syowa Station (69 deg S, 35.6 deg E) using 5000 cu. cm plastic balloons. JA21 balloon was launched on November 24, 1982, and JA25 and JA26 balloons on November 12 and 20, 1983, respectively. Author

N86-27820*# Tokyo Science Univ. (Japan).
DECOMPOSITION OF CO2 MOLECULES DUE TO AURORAL X-RAYS
K. Sekihara *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 p 466-470 (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

It has been reported by SEKIHARA (1981), that the circumpolar measurement from a commercial airliner reported by PRATT and FALCONER (1979) was subjected to a strong influence of a geomagnetic storm, specifically at the beginning stage through the North Pole. The main point of interest was the increase of CO concentration by the order of 10 ppb that took place simultaneously with a temperature decrease of several degrees, which was regarded as a result of enhanced cooling to space due to CO2 decomposition. Later inspection of the original magnetogram of eleven auroral zone stations revealed that the observation started 13 hours after the main phase of a geomagnetic storm, which lasted for 22 hours. A quantitative estimation is made of CO2 decomposition due to auroral X-rays that should take place during the degradation of photoelectrons injected into the lower stratospheres. Author

N86-27821*# Radio Research Labs., Tokyo (Japan).
VHF RADAR OBSERVATION OF THE MIDDLE ATMOSPHERE AT SYOWA STATION, ANTARCTICA
K. Igarashi, T. Ogawa, T. Tanaka, Y. Kuratani, R. Fujii (National Inst. of Polar Research, Tokyo, Japan), and T. Hirasawa *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 6 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The newly developed pulsed Doppler radars with 50 and 112 MHz were installed at Syowa Station (69 deg 00'S, 39 deg 35'E geographic; 70.0 deg S, 80.2 deg E geomagnetic) in 1982 and 1983, respectively. They have the nominal peak power of 15 kW; the narrow antenna beams (4 deg in the horizontal plane) in two different directions (approximately geomagnetic south and geographic south with a crossing angle of about 33 deg), the three operation modes (spectrum, double-pulse and meteor mode). The radars were designed to measure the intensity and Doppler velocity of auroral radar echoes due to the 3- and 1.34-m irregularities appearing often in the disturbed E region and also to detect the meteor echoes in the 80 to 100 km altitudes, thereby to clarify how the middle atmosphere in the polar region behaves in response to the energy input from the magnetosphere, especially during a substorm. Some initial results obtained through the radar operation during 1982 to 1983 are presented to show that this system is useful for continuous monitoring of the lower auroral ionosphere.
Author

N86-27822*# Adelaide Univ. (Australia). Institute for Antarctic Research.
WINDS IN THE LOWER THERMOSPHERE OVER MAWSON, ANTARCTICA
N. P. Jones and F. Jacka *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Measurements are presented of the neutral wind field in the lower thermosphere over Mawson, Antarctica, made during the austral Spring of 1981. The Mawson Institute's Fabry-Perot spectrometer was used to study the OI lambda 588 nm emission in the night airglow and aurora. Wind velocities were inferred from Doppler shifts of this emission.
Author

N86-27823*# Nagoya Univ. (Japan). Research Inst. of Atmospherics.
BALLOON MEASUREMENTS OF AEROSOL IN THE ANTARCTIC STRATOSPHERE
Y. Morita, M. Takagi, Y. Iwasaka, and A. Ono *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Three balloon soundings of aerosol were conducted from Syowa Station, Antarctica in April, June and October 1983. Number concentration and the size distribution of aerosol particles with diameter greater than 0.3 microns were measured by using a light scattering aerosol particle counter. The influence of the eruption of Mt. El Chichon on the aerosol concentration in the stratosphere was observed on October 16. Very high aerosol concentration at stratospheric heights was obtained from the first successful aerosol sounding in winter Antarctic stratosphere. The result gives direct evidence of winter enhancement in the Antarctic stratosphere.
Author

N86-27824*# Meteorological Research Inst., Tsukuba (Japan).
BALLOON-BORNE OBSERVATION OF AITKEN NUCLEI IN THE ANTARCTIC STRATOSPHERE AND TROPOSPHERE
Tomoyuki Ito, Miwako Ikegami, Izuo Kanazawa, and Yasunobu Iwasaka (Nagoya Univ., Japan) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 5 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Aitken nuclei (0.002 < or = r < or = 0.1 microns in the atmosphere are produced through gas-to-particle conversion processes, and they grow in size by heterogeneous nucleation processes and others to produce larger aerosol particles. In the study of global background aerosol pollution, full knowledge of such aerosol processes in the clean atmosphere is essentially required. In this sense, it is important to examine the behavior of aerosols in a clean atmosphere which is not contaminated directly by aerosols and gases emitted from the Earth's surface. The Antarctic atmosphere is thought to be such a clean atmosphere. From an extensive surface observation of aerosols carried out at Syowa Station (69 deg 00'S, 39 deg 35'E) Antarctica, it has been revealed that various phenomena relating to long-range transport of trace constituents and/or photochemical processes resulting in production or growth of aerosol particles are clearly observed in Antarctica. This paper gives a preliminary report of observations made by balloon-borne Aitken nuclei sonde in 1983, at Syowa Station.
Author

N86-27825*# Meteorological Research Inst., Tsukuba (Japan).
GAS-CHROMATOGRAPHIC MEASUREMENTS OF ATMOSPHERIC CF2Cl2, CFCl3 AND N2O IN ANTARCTICA
H. Hirota, Y. Makino, S. Chubachi, H. Muramatsu, and M. Shiobara (Tohoku Univ., Sendai, Japan) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Stratospheric ozone is produced photochemically and destroyed by reactions with such minor constituents as O, NOx, HOx, and ClOx. Chlorofluoromethanes (CF2Cl2 and CFCl3) and dinitrogen oxide (NwO) are considered as major sources of the stratospheric ClOx and NOx, respectively. It is well known that CF2Cl2 and CFCl3 are released only by man's activities, and are being accumulated in the troposphere. In order to assess the influence of these compounds on the natural ozone balance these gases have been measured over Japan since 1978. Measurements of Antarctic air samples are also indispensable to understanding the global distributions of these gases, because most CF2Cl2 and CFCl3 have been released in the Northern Hemisphere. Antarctic air samples were obtained by the 23rd, 24th and 25th Japanese Antarctic Research Expeditions, and analyzed by a gas-chromatographic method using an electron capture detector. Three experimental results were obtained: (1) latitudinal distribution of these gases from Tokyo to Syowa Station (69.0 deg S, 39.6 deg E), (2) time trends at Syowa Station, and (3) vertical distributions over Syowa Station. Results are reported.
Author

N86-27826*# Radio Research Labs., Tokyo (Japan).
THE 50-MHz METEOR RADAR OBSERVATION AT SYOWA STATION, ANTARCTICA
T. Tanaka, T. Ogawa, K. Igarashi, and R. Fujii (National Inst. of Polar Research, Tokyo, Japan) *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The 50-MHz Doppler radar installed at Syowa Station (69 deg 00'S, 39 deg 35'E), Antarctica, in 1982 can detect continuously a meteor echo if an operator assigns the meteor mode operation to the radar. The radar has two narrow antenna beams (4 deg in the horizontal plane), one toward geomagnetic south and the other toward approximately geographic south, with a crossing angle of about 33 deg. The minicomputer annexed to the radar controls

the transmission and reception of a 50-MHz wave. If the receiver detects a meteor echo, the flag signal is sent to the computer. Then the computer begins to determine the echo range with a time resolution of 1 micro s and to sample every 200 microns/s for 1 s the Doppler signal and echo intensity at the particular range (R). The line-of-sight velocity (V sub D) of the echo trail is calculated from the output from the Doppler signal detection circuit having an offset frequency by using the so-called zero-crossing method. The echo amplitude decay time calculated by a least-mean square method is used to obtain the ambipolar diffusion coefficient (D) and then to calculate the echo height (H). About 120 day observations were made during 1982-1983. Some early results are presented. magnetic tapes together with V sub D, D, H and R for later analysis in Japan. About 120 day observation were made during 1982-1983. Some early results are presented. Author

N86-27827*# National Inst. of Polar Research, Tokyo (Japan).
RESEARCH ACTIVITIES ON ANTARCTIC MIDDLE ATMOSPHERE BY JARE 25TH TEAM
T. Hirasawa, H. Fukunishi, M. Ayukawa, M. Ejiri, Y. Iwasaka (Nagoya Univ., Japan), M. Tanaka (Tohoku Univ., Sendai, Japan), and R. Fujii *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The Antarctic Middle Atmosphere (AMA)-Japan research project was set about by the JARE (Japan Antarctic Research Expedition) 23rd team in 1982, and since then the JARE-24th and JARE-25th teams have been continuing reseach on the Antarctic Middle Atmosphere. Results gained by JARE-25th team members who are now working at Syowa Station (69.99 deg S, 39.35 deg E), Antarctica are presented. In their activities satellite measurements (Exos-C) and rocket soundings are used. Three rockets of the S310 type were launched at Syowa Station (Geomagnetic Latitude = 69.9 deg S) for the purpose of directly observing the electron density, ionospheric temperature, auroral patterns and luminosity in situ. Vertical profiles of electron density and auroral emission 4278A measured by three rockets are compared. Author

N86-27828*# National Inst. of Polar Research, Tokyo (Japan).
OBSERVATION OF TOTAL OZONE FIELDS IN THE ANTARCTIC ATMOSPHERE FROM TOVS OF TIROS-N/NOAA
T. Yamanouchi, Sadao Kawaguchi, I. Iwashina (University of Electro-Communications, Tokyo, Japan), and K. Suzuki *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Total ozone amounts in the Antarctic atmosphere are derived from infrared nadir scanning data of TIROS Operational Vertical Sounder (TOVS) of NOAA-6 and 7. HRPT data of the TIROS-N NOAA series of meteorological satellites have been received at Syowa Station (69 deg 00'S, 39 deg 35'E), Antarctica, about once a day since February 1980, by the Japanese Antarctic Research Expedition. HIRS/2 data of TOVS were extracted from HRPT data after being converted into CCT at the home institute. Total ozone amounts were derived for the northeastern part of the Antarctic, for about 100 orbits in 1981 and 1982. Author

N86-27829*# Tokyo Univ. (Japan). Geophysics Research Lab.
SEASONAL AND DIURNAL VARIATION OF THE ATMOSPHERIC NO2 AT SYOWA STATION, ANTARCTICA
K. Shibasaki *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 4 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

Extensive attention has been directed to nitrogen dioxide (NO2) since its important role in the atmospheric chemistry relating to the stratospheric ozone (e.g., WMO, 1982) has been pointed out. However, the behavior of NO2 in the atmosphere has still not been fully confirmed, although ground-based, balloon and satellite measurements of NO2 have been reported by many scientists. Especially, only a few measurements made at high latitude in the Southern Hemisphere have been reported. The total atmospheric NO2 by ground-based visible absorption spectroscopy at Syowa Station (69 deg S, 39.6 deg E), Antarctica. The observation continued from March 1983, to January 1984. The principles of measurement, instrumentation and the method of data analysis are described in detail. Author

N86-27830*# Nagoya Univ. (Japan). Water Research Inst.
THE CHANGE OF DEPOLARIZATION OF BACKSCATTERING LIGHT FROM THE POLAR STRATOSPHERIC AEROSOL LAYER
Y. Iwasaka *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The change of polarization properties of scattered light strongly depends on the non-spherisity of target particles. It should be helpful information for the study of stratospheric aerosols to know the non-spherisity of stratospheric aerosol particles. The change of the total backscatter depolarization ratio of the stratospheric aerosol layer measured at Syowa Station (69.00 deg S, 39.35 deg E), Antarctica is described. Author

N86-27831*# Nagoya Univ. (Japan). Water Research Inst.
THE STRATOSPHERIC AEROSOL PARTICLE MEASUREMENT BY BALLOON AT SYOWA STATION (69.00 DEG S, 39.35 DEG E): OUTLINE OF SPECIAL SONDE (RUBBER) CAMPAIGN JARE 24
Y. Iwasaka, T. Morita, T. Itoh (Meteorological Research Inst., Tsukuba, Japan), K. Shibazaki (Tokyo Univ., Japan), Y. Makino (Meteorological Research Inst., Tsukuba, Japan), T. Tanaka (Radio Research Labs., Tokyo, Japan), K. Tsukamura (Japan Meteorological Agency, Tokyo), T. Yano, K. Kondoh, and G. Iwashita *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

During the period of AMA (Antarctic Middle Atmosphere), various style balloons were used to measure atmospheric parameters at Syowa Station (69.00 deg S, 39.35 deg E), Antarctica. The measurements which were made using balloons specially designed to monitor stratospheric aerosol particles are discussed. This type balloon was first used by JARE (Japan Antarctic Research Expedition) 24th Team in 1983. Until that time, the Japan Antarctic Research Expedition Team had been using only a large plastic balloon to monitor various minor constituents in the stratosphere. The plastic balloon was very useful, but it took a long time to arrange a balloon launching. Additionally, launching time strongly depended on weather conditions. A timely launching of the balloon was carried out with this specially designed sonde. Author

N86-27832*# Nagoya Univ. (Japan). Water Research Inst.
WATER VAPOR CONTENT IN THE POLAR ATMOSPHERE MEASURED BY LYMAN-ALPHA/OH FLUORESCENCE METHOD
Y. Iwasaka, S. Saitoh, and A. Ono *In* International Council of Scientific Unions Handbook for MAP, Vol. 18 Dec. 1985 3 p (For primary document see N86-27719 18-46)
Avail: NTIS HC A23/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04A

The water vapor of the polar stratosphere possibly plays an important role in various aeronomical processes; for example, OH radical formation through photodissociation of H2O, formation of

water cluster ions, radiative energy transfer in the lower stratosphere, condensation onto particulate matter, and so on. In addition to these, it has been speculated, from the viewpoint of global transport and/or budget of water vapor, that the polar stratosphere functions as an active sink. STANFORD (1973) emphasized the existence of the stratospheric Cist cloud in the polar stratosphere which brought a large loss rate of stratospheric water vapor through a so-called freeze-out of cloud particles from the stratosphere into the troposphere. However, these geophysically interesting problems unfortunately remain to be solved, owing to the lack of measurements on water vapor distribution and its temporal variation in the polar stratosphere. The water vapor content measured at Syowa Station (69.00 deg S, 39.35 deg E), Antarctica using a balloon-borne hygrometer (Lyman - alpha/OH fluorescence type) is discussed. Author

N86-27833*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth, Atmospheric and Planetary Sciences.

PLATE MOTIONS AND DEFORMATIONS FROM GEOLOGIC AND GEODETIC DATA Semiannual Report, 1 Aug. 1983 - 31 Dec. 1985

Thomas H. Jordan 1986 53 p

(Grant NAG5-459)

(NASA-CR-177313; NAS 1.26:177313) Avail: NTIS HC A04/MF A01 CSCL 08E

A satellite laser ranging experiment conducted by NASA since 1972 has measured the relative motion between the North America and Pacific plates in California. Based on these measurements, the 896-km distance between San Diego and Quincy, California, is shortening at 62 + or - 9 mm/yr. This geodetic estimate is consistent with the rate of motion between the two plates, calculated from geological data to be 53 + or - 3 mm/yr averaged over the past few million years. Author

N86-27834*# California Univ., Los Angeles. Dept. of Atmospheric Sciences.

INVESTIGATION OF THE DAYSIDE BOUNDARY REGION OF THE MAGNETOSPHERE Final Technical Report, 1 May 1979 - 31 Mar. 1985

Nancy Crooker Jun. 1985 7 p

(Grant NsG-5351)

(NASA-CR-177275; NAS 1.26:177275) Avail: NTIS HC A02/MF A01 CSCL 04A

The region near the dayside boundary of the magnetosphere is of particular interest mainly because it is the most likely site for solar wind energy transfer. Exactly where and how this transfer occurs is one of the basic problems of magnetospheric physics. The global nature of the energy transfer is addressed in this research. In order to test whether energy transfer affects the large scale plasma flow in the magnetosheath, global properties of the magnetosheath were analyzed and compared to models with no energy transfer. Also, global models of merging sites on the magnetopause were modeled with the aid of the magnetosheath models. Since energy transfer and intrinsic magnetosheath properties depend upon the orientation of the interplanetary magnetic field (IMF), it was essential to have an IMF monitor for these studies. In the course of using ISEE 3 in this role, statistical studies were performed to test the accuracy of using data from an orbit so far upstream. Global properties of the magnetosheath energetic ion population, magnetic field strength and orientation, and flow pattern, determined with ISEE data are summarized.B.W.

N86-27835*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AIRBORNE LIDAR MEASUREMENTS OF EL CHICHON STRATOSHPERIC AEROSOLS

M. Patrick McCormick and M. T. Osborn (SASC Technologies, Inc., Hampton, Va.) Jul. 1982 49 p Supersedes NASA-RP-1136; NASA-RP-1148

(NASA-RP-1166; L-16107; NAS 1.61:1166) Avail: NTIS HC A03/MF A01 CSCL 04A

A NASA Electra airplane outfitted with a lidar system was flown in July 1982 between the latitudes of 42 deg. N and 12 deg. N. The primary purpose of this mission was to determine the spatial distribution and aerosol characteristics of the El Chichon-produced stratospheric material. This report presents the lidar data from that flight mission. Representative profiles of lidar backscatter ratio, plots of the integrated backscattering function versus latitude, and contours of backscatter mixing ratio versus altitude and latitude are given. In addition, tables containing numerical values of the backscatter ratio and backscattering functions versus altitude are supplied for each profile. The largest amount of material produced by the El Chichon eruptions of late March-early April 1982 which was measured by this flight resided south of 30 deg. N and was concentrated above 21 km in a layer that peaked at 24 to 27 km. In this latitude region, peak backscatter ratios at a wavelength of 0.6943 microns were approximately 50, and peak optical depths were calculated to be 0.2. This report presents the results of this mission in a ready-to-use format for atmospheric and climatic studies. Author

N86-27836*# Florida State Univ., Gainesville. Dept. of Meteorology.

SENSTITIVITY ANALYSIS OF HORIZONTAL HEAT AND VAPOR TRANSFER COEFFICIENTS FOR A CLOUD-TOPPED MARINE BOUNDARY LAYER DURING COLD-AIR OUTBREAKS M.S. Thesis

Yuwen Vaughn Chang Apr. 1986 332 p

(Grant NAG5-332)

(NASA-CR-177282; NAS 1.26:177282) Avail: NTIS HC A06/MF A01 CSCL 04A

The effects of external parameters on the surface heat and vapor fluxes into the marine atmospheric boundary layer (MABL) during cold-air outbreaks are investigated using the numerical model of Stage and Businger (1981a). These fluxes are nondimensionalized using the horizontal heat (g1) and vapor (g2) transfer coefficient method first suggested by Chou and Atlas (1982) and further formulated by Stage (1983a). In order to simplify the problem, the boundary layer is assumed to be well mixed and horizontally homogeneous, and to have linear shoreline soundings of equivalent potential temperature and mixing ratio. Modifications of initial surface flux estimates, time step limitation, and termination conditions are made to the MABL model to obtain accurate computations. The dependence of g1 and g2 in the cloud topped boundary layer on the external parameters (wind speed, divergence, sea surface temperature, radiative sky temperature, cloud top radiation cooling, and initial shoreline soundings of temperature, and mixing ratio) is studied by a sensitivity analysis, which shows that the uncertainties of horizontal transfer coefficients caused by changes in the parameters are reasonably small. Author

N86-27837*# Florida State Univ., Gainesville. Dept. of Meteorology.

A MODEL FOR THE ESTIMATION OF THE SURFACE FLUXES OF MOMENTUM, HEAT AND MOISTURE OF THE CLOUD TOPPED MARINE ATMOSPHERIC BOUNDARY LAYER FROM SATELLITE MEASURABLE PARAMETERS M.S. Thesis

Donald Eugene Allison Aug. 1984 73 p

(Grant NAG5-332)

(NASA-CR-177283; NAS 1.26:177283) Avail: NTIS HC A04/MF A01 CSCL 04A

A model is developed for the estimation of the surface fluxes of momentum, heat, and moisture of the cloud topped marine atmospheric boundary layer by use of satellite remotely sensed parameters. The parameters chosen for the problem are the integrated liquid water content, q sub li, the integrated water vapor content, q sub vi, the cloud top temperature, and either a measure of the 10 meter neutral wind speed or the friction velocity at the surface. Under the assumption of a horizontally homogeneous, well-mixed boundary layer, the model calculates the equivalent potential temperature and total water profiles of the boundary layer along with the boundary layer height from inputs of q sub li, q sub vi, and cloud top temperature. These values, along with the 10m neutral wind speed or friction velocity and the sea surface temperature are then used to estimate the surface fluxes. The development of a scheme to parameterize the integrated water

vapor outside of the boundary layer for the cases of cold air outbreak and California coastal stratus is presented. Author

N86-27838*# Florida State Univ., Tallahassee. Dept. of Meteorology.
AN INVESTIGATION OF THE MARINE BOUNDARY LAYER DURING COLD AIR OUTBREAK Final Report
Steven A. Stage Jul. 1986 26 p
(Grant NAG5-332)
(NASA-CR-177249; NAS 1.26:177249) Avail: NTIS HC A03/MF A01 CSCL 04A

Three techniques were developed and tested for use in the remote estimation of ocean surface heat and vapor fluxes. Methods for measurement of surface sensible and latent heat fluxes discussed include: satellite measurement, marine atmospheric boundary layer (MABL) model, and horizontal transfer coefficients. The accuracy and applicability of the methods are examined. Publications and papers are listed. B.G.

N86-27839*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INTRODUCTION TO THE THEORY OF ATMOSPHERIC RADIATIVE TRANSFER
James J. Buglia Jul. 1986 171 p
(NASA-RP-1156; L16068; NAS 1.61:1156) Avail: NTIS HC A08/MF A01 CSCL 04A

The fundamental physical and mathematical principles governing the transmission of radiation through the atmosphere are presented, with emphasis on the scattering of visible and near-IR radiation. The classical two-stream, thin-atmosphere, and Eddington approximations, along with some of their offspring, are developed in detail, along with the discrete ordinates method of Chandrasekhar. The adding and doubling methods are discussed from basic principles, and references for further reading are suggested.
Author

N86-27840*# Texas Univ., Dallas.
STUDIES OF DYNAMO FIELD STRUCTURE AND RELATED EFFECTS: DE SATELLITE PROJECT GUEST INVESTIGATOR PROGRAM Final Report
W. R. Coley Jul. 1986 28 p
(Grant NAG5-450)
(NASA-CR-177222; NAS 1.26:177222) Avail: NTIS HC A03/MF A01 CSCL 04A

The establishment of the latitudinal and longitudinal structure of the low latitude dynamo electric field was initiated using data primarily from the Unified Abstract (UA) files of the Atmosphere Explorer E (AE-E) satellite. Mass plots of the vertical ion drift values were made for 1977, 1978, and 1979. The average diurnal variation of V sub v within 20 degrees of the dip equator is remarkably similar to that obtained at Jicamarca in the same years. The average meridional ion drift velocity vectors, obtained as a function of latitude by combining the average vertical and horizontal (nearly north-south) ion drift values from the AE-E, showed the expected variations with local time and season based on the well known equatorial fountain effect theory. The average diurnal variation of the vertical drift was found for four different ranges of dip latitude for a northern solstice season. The effect of the transequatorial neutral winds was as evident in this plotting format as in the meridional or fountain effect format. Finally, the average vertical drift velocity V sub v, not the east-west electric field E sub ew, was found to be approximately independent of longitude, as expected from the dynamo theory. B.G.

N86-27841# Science Applications International Corp., San Diego, Calif.
HIGH FREQUENCY P WAVE ATTENUATION AND DEGRADATION OF DETECTION CAPABILITY BY LARGE EARTHQUAKES Semiannual Technical Report, Dec. 1984 - Jun. 1985
Thomas C. Bache and Steven R. Bratt 5 Sep. 1985 64 p
(Contract F19628-85-C-0021)
(AD-A164733; SAIC-85/1820; AFGL-TR-85-0211; SATR-1) Avail: NTIS HC A04/MF A01 CSCL 08/11

This report describes two distinct seismological studies. The first is High Frequency P Wave Attenuation Along Five Teleseismic Paths from Central Asia. P Wave spectra from E. Kazakhstan explosions recorded at five arrays are computed for all five paths using an absorption band model. The Q exhibits strong frequency dependence in the band from 0.5 to 3 Hz, and is nearly the same for all five paths. The second study is, An Investigation of the Degradation of Teleseismic Detection Capability Caused by Large Earthquakes. A ten year global seismicity bulletin is searched to determine the extent to which large earthquakes inhibit the detection of small earthquakes occurring a short time thereafter. Significant degradation of the detection capability of the 115 station global network contributing to the bulletin is seen for periods up to an hour for earthquakes of M sub b 5.8 and larger. GRA

N86-27842# Alberta Univ., Edmonton. Dept. of Physics.
DEVELOPMENT OF COMPUTER PROGRAMS AND RELATED SOFTWARE FOR THE DETECTION AND ANALYSIS OF PI2 PULSATIONS RECORDED AT GROUND BASED STATIONS Final Report, 2 Mar. 1982 - 2 Sep. 1985
J. C. Samson 2 Sep. 1985 33 p
(Contract F19628-82-K-0032)
(AD-A165224; AFGL-TR-85-0146) Avail: NTIS HC A03/MF A01 CSCL 04/1

The major objectives of the study were to develop algorithms for the estimation of the polarization states of Pi 2 geomagnetic pulsations, to code these algorithms in FORTRAN, and to develop models for the prediction of the polarization states of Pi 2's. The Pi 2 models are based on the magnetic fields associated with transient field-aligned currents, on geomagnetic field lines threading the auroral ionosphere. These models have proven to be extremely successful in predicting the polarization states of high and mid latitude Pi 2's. The computer programs are based on algorithms for detecting pure states, and estimating the parameter of pure states or polarized waves in multiple time series. All the software for these algorithms has been written in FORTRAN, and the programs have been used with considerable success in the parameterization of the polarization states of Pi 2's. GRA

N86-27843# Massachusetts Univ., Amherst. Astronomy Research Facility.
PROCESSING OF SCRIBE DATA Final Report, Oct. 1983 - Sep. 1985
Hajime Sakai Sep. 1985 83 p
(Contract F19628-84-K-0009)
(AD-A165226; UMASS-ARF-85-001; AFGL-TR-85-0279) Avail: NTIS HC A05/MF A01 CSCL 04/1

The SCRIBE experiments were conducted for the purpose of observing the atmospheric infrared emission by using a cryogenic interferometer spectrometer mounted on a balloon-borne platform. The data collected during the flight by the spectrometer were transmitted through the radio telemetry link and were received at the ground station of Holloman AFB where these flights were monitored. They were recorded on analog 1/2 in magnetic tapes running at 60 ips. By playing back these tapes, the telemetry signal transmitted from the balloon-borne package was reproduced at our site for processing efforts to retrieve the interferogram data out of the played-back telemetry signal, and to recover the spectral data corresponding to radiation emitted by the atmosphere were the main objective of this work. In addition to the Holloman tapes, a mobile telemetry signal-receiving unit of AFGL was used to record the flight data on similar analog tapes for the Jul-05-1984 flight launched from Roswell, New Mexico.
GRA

N86-27844# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth Atmospheric and Planetary Sciences.
INVESTIGATION OF EURASIAN SEISMIC SOURCES AND UPPER MANTLE STRUCTURE Semiannual Report, No. 1, 6 Dec. 1984 - 30 Jun. 1985
Thomas H. Jordon 30 Jun. 1985 40 p
(Contract F19628-85-K-0024)
(AD-A165228; AFGL-TR-85-0206) Avail: NTIS HC A03/MF A01

CSCL 08/11

Complex P-SV wavegroups are successfully fit on vertical component seismograms for paths crossing northern Eurasia with a model having a 39 km crust and no asthenospheric low-velocity zone. Between the Moho and the 400 km discontinuity, the shear velocities found from the P-SV waveform analysis are consistently lower than those inferred from the SH waveform modeling of Grand and Helmberger. We suggest that this discrepancy is diagnostic of a polarization anisotropy associated with the olivine rich mineralogy of the thick, basalt depleted chemical boundary layer that characterizes the upper mantle beneath stable continents. The vertical resolving power of source and receiver array are investigated in determining Eurasian crustal and upper mantle structure using waveform inversion technique of Lerner-Lam and Jordan (1983). The results show that good resolution of upper mantle structure can be obtained with this method from sparse arrays of sources and/or receivers. Source arrays are particularly effective in enhancing resolution, provided that the source depths are well distributed and the source centroids and moment tensors are well determined, while receiver arrays contribute to the reduction of the variance of the model estimates. GRA

N86-27845# Royal Norwegian Council for Scientific and Industrial Research, Kjeller.
THE NORWEGIAN SEISMIC ARRAY (NORSAR) Final Technical Summary, 1 Apr. - 30 Sep. 1985 on
L. B. Loughran, ed. Dec. 1985 137 p
(Contract F08606-84-C-0002)
(AD-A165243; NORSAR-Contrib-362; NORSAR-Scientific-1/85/86) Avail: NTIS HC A07/MF A01 CSCL 08/11

Using a data base of about 170 NORSAR-recorded seismic events at regional distances during the past 15 years, a detailed map of propagation characteristics of short period regional seismic phases has been compiled. Lg shows efficient propagation out to about 20 deg at 1 Hz and 10 deg at 4 Hz over continental shield paths (e.g., to the east ot te array), whereas Sn is the dominant secondary phase for paths tha cross significant tectonic features like graben structures and continental margins. The NORESS on-line detection and location performance have been evaluated both for regional and teleseismic events. A case study of 132 Western Norwar/North Sea events has indicated a detection threshold of M sub L 1.5-2.0 for NORESS. The NORESS epicentral solutions are in most cases consistent with those provided by the Western Norway seismic network. For one site where a large number of known explosions (36) were processed, the average NORESS location error was 10 km. A statistical study of NORESS detections during Apr-Sep 1985 has shown an average of about 100 detections per day, of which about 20% are teleseismic P phases, about 25% regional p phases and the remaining 55% have slow phase velocities (< 6 km/s) correspo nding to secondary phases or possibly noise detections. GRA

N86-27846# Utah State Univ., Logan. Space Dynamics Labs.
ANALYSIS OF FIELD-WIDENED INTERFEROMETER DATA BY LEAST-SQUARES AND SPECTRAL DECONVOLUTION METHODS
A. S. Zachor, R. D. Sharma, J. R. Winick, and R. H. Picard 31 May 1985 72 p Prepared in cooperation with Atmospheric Radiation Consultants, Acton, Mass.
(Contract F19628-83-C-0056)
(AD-A165253; SDL/85-033; AFGL-TR-85-0132; SR-8) Avail: NTIS HC A04/MF A01 CSCL 04/1

Linear least-squares methods and the Jansson method of constrained nonlinear spectral deconvolution were used to analyze atomspheric emission spectra obtained in the Field-Widened Interferometer (FWI) experiment. The analysis provides estimates of line intensities and spectra of enhanced resolution. A conclusion of the study is that NO+ was not present in the auroral event observed by the FWI. GRA

N86-27847# Air Force Geophysics Lab., Hanscom AFB, Mass.
A SURVEY OF KNOWN INDICATORS OF AURORAL SUBSTORM ONSET Research Report, 1 Jan. - 9 May 1985
John O. Wise 29 Aug. 1985 50 p
(AD-A165276; AFGL-TR-85-0197; AFGL-ERP-926) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report summarizes current research in the area of auroral substorm prediction. Long term indicators are investigated; in particular the solar cycle solar flares coronal holes, and the tendency for these phenomena to recur. Short term indicators are also reviewed; recurrence probability in Defense Meteorological Satellite Program images, the solar winds and the interplanetary magnetic field, the equatorward boundary of the auroral oval, electron density dropouts at geosynchronous orbit, visual observations from the ground, magnetometer measurements, auroral radar and riometer measurements. GRA

N86-27848# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth, Atmospheric and Planetary Sciences.
MICROCRACKS AND ENERGY Progress Report, 1 Mar. 1984 - 15 Mar. 1985
G. Simmons 17 Feb. 1986 69 p
(Contract DE-AC02-78ER-04972)
(DE86-000217; DOE/ER-04972/T4) Avail: NTIS HC A04/MF A01

Progress is reported on a study of the role of microcracks in the transport of uranium in crystalline rocks. The focus is on the conditions under which the migration or fixation occurs. DOE

N86-27849# Kiruna Geophysical Inst. (Sweden).
ON THE GENERATION OF AURORAL ARCS AND INVERTED-V STRUCTURES Thesis
K. Stasiewicz Oct. 1985 61 p
(KGI-191; ISSN-0347-6405; ESA-86-96739) Avail: NTIS HC A04/MF A01

The origin of the auroral inverted-V electron spectra; the influence of a turbulent region on the flux of auroral electrons; a statistical study of precipitating electrons; the formation of auroral arcs; and generation of magnetic-field aligned currents, parallel electric fields and inverted-V structures by plasma pressure inhomogeneities in the magnetosphere are discussed. ESA

N86-27850# National Oceanic and Atmospheric Administration, Boulder, Colo.
AERONOMY LABORATORY Annual Report, 1 Oct. 1984 - 30 Sep. 1985
Oct. 1985 103 p
(PB86-182912) Avail: NTIS HC A06/MF A01 CSCL 04A

The Aeronomy Laboratory (NOAA) Annual Report for Fiscal Year 1985 covers the following topics: Atmospheric sampling; Optical aeronomy; Theoretical aeronomy; Atmospheric chemical kinetics; Atmospheric dynamics; Tropical dynamics and climate; Theoretical wave and turbulence. GRA

N86-27339# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
MAGNETOSPHERE-IONOSPHERIC COUPLING
C.-G. Faelthammar *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 107-133 Original language document was announced as N86-24071 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27341# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
GENERATION OF FIELD-ALIGNED CURRENT STRUCTURES AT SUBSTORM ONSETS
A. Roux *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 151-159 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27483# Joint Publications Research Service, Arlington, Va.
INSTABILITY IN LOWER IONOSPHERE AT LOW LATITUDE
Xuanmou Liu, Genghou Liu, Tao Gu, and Rong Cui *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986

p 63-71 Transl. into ENGLISH from Wuhan Daxue Xuebao (Ziran Kexue Ban) (Wuhan, China), no. 2, Jun. 1984 p 39-44 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27532# Alaska Univ., Fairbanks. Geophysical Inst.
SOLAR-TERRESTRIAL RELATIONSHIPS IN THE HIGH LATITUDE REGION
S.-I. Akasofu *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 17 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

N86-27537# Boston Univ., Mass. Dept. of Astronomy.
F LAYER IRREGULARITIES AT PLASMAPAUSE AND AURORAL LATITUDES
Jules Aarons *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 16 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

N86-27548# Forschungsinstitut der Deutschen Bundespost, Darmstadt (West Germany).
OBSERVATIONS WITH AN IONOSONDE IN NORTHERN GERMANY NEAR THE MID-LATITUDE TROUGH
Thomas Damboldt *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 5 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

N86-27551# Toulon Univ. (France). Lab. de Sondages Electromagnetiques de l'Environment.
SMALL-SCALE IRREGULARITIES IN THE HIGH-LATITUDE F REGION
C. Hanuise, J. P. Villain, C. Beghin (Centre National de la Recherche Scientifique, Orleans, France), and G. Caudal (Centre National de la Recherche Scientifique, Saint-Maur-des-Fosses, France) *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 12 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

N86-27552# SRI International Corp., Menlo Park, Calif. Radio Physics Lab.
ON THE RELATIONSHIP OF F-REGION STRUCTURE IN THE DAYSIDE AURORAL OVAL TO HF BACKSCATTER SIGNATURES ATTRIBUTED TO THE POLAR CUSP
J. D. Kelly, R. T. Tsunoda, J. K. Olesen (Danish Meteorological Inst., Copenhagen.), and P. Stauning *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 10 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

N86-27553# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.
OBSERVATIONS OF VERY HIGH LATITUTDE IONOSPHERIC IRREGULARITIES WITH THE GOOD BAY HF RADAR
R. A. Greenwald and K. B. Baker *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 17 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

N86-27554# Utah State Univ., Logan. Center for Atmospheric and Space Sciences.
OBSERVATIONS OF THE MID-LATITUDE IONOSPHERIC TROUGH FROM ANTARCTICA
F. T. Berkey and M. J. Jarvis (British Antarctic Survey, Cambridge (England).) *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 25 p (For primary document see N86-27531 18-32)
(Grants NSF DPP-81-00220; NSF DPP-83-08044)
Avail: NTIS HC A25/MF A01

N86-27555# British Antarctic Survey, Cambridge (England).
THE VARIABILITY AND PREDICTABILITY OF THE MAIN F-REGION TROUGH DETERMINED USING DIGITAL IONOSPHERIC SOUNDER DATA
Alan S. Rodger and John R. Dudeney *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 11 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

N86-27556# Alaska Univ., Fairbanks. Geophysical Inst.
PROGRESS IN MODELLING THE POLAR IONOSPHERE FROM SOLAR AND MAGNETOSPHERE PARAMETERS
B. J. Watkins, S.-I. Akasofu, and C. D. Fry *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 5 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

N86-27558*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Computer Scien
FORMATION AND DETECTION OF HIGH LATITUDE IONOSPHERIC IRREGULARITIES
M. C. Lee, J. Buchau (Air Force Geophysics Lab., Hanscom AFB, Mass.), H. C. Carlson, Jr., J. A. Klobuchar, and E. J. Weber *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 14 p (For primary document see N86-27531 18-32)
(Grant NAG5-270; Contract F19628-83-K-0024)
Avail: NTIS HC A25/MF A01

N86-27559# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
DIRECT, IN-SITU MEASUREMENTS OF IRREGULARITIES IN THE MESOSPHERE (85 - 50 km) AT 69 DEG N (ANDENES, NORWAY)
Hans-Ulrich Widdel *In* AGARD Propagation Effects on Military Systems in the High Latitude Region Nov. 1985 10 p (For primary document see N86-27531 18-32)
Avail: NTIS HC A25/MF A01

N86-27695# Meteorological Satellite Center, Tokyo (Japan).
ON LAND-SEA CONTRAST IN THE EARTH RADIATION BUDGET
Isao Kubota and Hiroko Imai *In its* Meteorological Satellite Center Technical Note, no. 13, 1986 (ISSN-0388-9653) Mar. 1986 p 1-31 In JAPANESE; ENGLISH summary (For primary document see N86-27694 18-42)
Avail: NTIS HC A04/MF A01

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N86-27851# Radio Technical Commission for Aeronautics, Washington, D. C.
MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR AIRBORNE THUNDERSTORM DETECTION EQUIPMENT
May 1986 75 p
(RTCA/DO-191) Avail: NTIS HC A04/MF A01

Minimum operational performance standards for non-radar airborne thunderstorm detection equipment are explained in this document. These standards specify system characteristics that should be useful to designers, manufacturers, installers and users of the equipment. Information needed to understand the rationale for equipment characteristics and requirements is given. Typical equipment applications and operational goals as envisioned by Special Committee 154 are discussed. The minimum performance standards for the equipment are given. These standards specify the required performance under standard and environmental conditions. Also included are recommended bench test procedures necessary to demonstrate equipment compliance with the stated minimum requirements. Tests for the installed equipment are included when performance cannot be adequately determined through bench testing. The operational performance characteristics for equipment installations are described and conditions that will

assure the equipment is used properly in the expected operational environment are defined. B.W.

N86-27852*# Florida State Univ., Tallahassee. Coll. of Arts and Sciences.
SENSITIVITY ANALYSIS OF HORIZONTAL HEAT AND VAPOR TRANSFER COEFFICIENTS FOR A CLOUD-TOPPED MARINE BOUNDARY LAYER DURING COLD-AIR OUTBREAKS M.S. Thesis
Yuwen Vaughn Chang Apr. 1986 113 p refs
(Grant NAG5-332)
(NASA-CR-177292; NAS 1.26:177292) Avail: NTIS HC A06/MF A01 CSCL 04B

The effects of external parameters on the surface heat and vapor fluxes into the marine atmospheric boundary layer (MABL) during cold-air outbreaks are investigated using the numerical model of Stage and Businger (1981a). These fluxes are nondimensionalized using the horizontal heat (g1) and vapor (g2) transfer coefficient method first suggested by Chou and Atlas (1982) and further formulated by Stage (1983a). In order to simplify the problem, the boundary layer is assumed to be well mixed and horizontally homogeneous, and to have linear shoreline soundings of equivalent potential temperature and mixing ratio. Modifications of initial surface flux estimates, time step limitation, and termination conditions are made to the MABL model to obtain accurate computations. The dependence of g1 and g2 in the cloud topped boundary layer on the external parameters (wind speed, divergence, sea surface temperature, radiative sky temperature, clould top radiation cooling, and initial shoreline soundings of temperature) studied by a sensitivity analysis, which shows the uncertainties of horizontal transfer coefficients caused by changes in the parameters are reasonably small. Therefore, the surface heat and vapor fluxes are also weakly dependent on the external parameters, and can be well estimated by the horizontal transfer coefficient method even from rather poor measurements. M.G.

N86-27853*# Florida State Univ., Tallahassee. Coll. of Arts and Sciences.
A MODEL FOR THE ESTIMATION OF THE SURFACE FLUXES OF MOMENTUM, HEAT, AND MOISTURE OF THE CLOUD-TOPPED MARINE ATMOSPHERIC BOUNDARY LAYER FROM SATELLITE MEASURABLE PARAMETERS M.S. Thesis
Donald Eugene Allison Aug. 1984 74 p
(Grant NAG5-332)
(NASA-CR-177290; NAS 1.26:177290) Avail: NTIS HC A04/MF A01 CSCL 04B

A model for the estimation of the surface fluxes of momentum, heat, and moisture of the cloud topped marine atmospheric boundary larver was developed by use of satellite remotely sensed prarameters. The parameters chosen for the problem were the integrated liquid water content, the integrated water vapor content, the cloud top temperature, the sea surface temperature, and either a measure of the 10 meter neutral wind spread or the friction velocity at the surface. Under the assumptions of a horizontally homogeneous, well-mixed boundary layer, the model calculates the equivalent potential temperature and total water profiles of the boundary layer along with the boundary layer height. The development of a scheme to parameterize the integrated water vapor outside of the boundary layer for the cases of cold air outbreak and California coastal stratus is presented. Sensitivity studies are presented showing the potential accuracy of this technique. With improvements of current technology, the model will provide reasonable estimates of the surface fluxes. Author

N86-27854# National Aeronautical Lab., Bangalore (India).
THE WIND ENVIRONMENT IN INDIA
Roddam Narasimha Dec. 1985 53 p
(TM-DU-8501) Avail: NTIS HC A04/MF A01

A major issue of wind engineering is the formulation of a rational method of estimating wind loads in different parts of the country. The building code in current use is not consistent with published estimates of extremes, which in turn are only in broad qualitative agreement with each other. A thorough re-examination is needed. The mean winds appear well understood, and are dominated by the monsooons and the remnants of the Findlater jet that blows across the Arabian Sea. The country is generally characterized by a relatively high extreme/mean ratio, posing difficult problems for the windmill designer. Statistical data needed for wind energy applications is now available, but a need for micro-surveys still exists. The variation of monthly means over the year can be compactly described in terms of two empirically defined orthogonal modes, corresponding roughly to the south-west and north-east monsoons. The meager data available on gust frequencies required in aeronautical applications show them to be relatively high. A variety of other phenomena important in aviation, from mountain waves to microbursts, still need to be investigated. B.G.

N86-27855*# LuTech, Inc., Hayward, Calif.
ANALYSIS OF DIRECT AND NEARBY LIGHTNING STRIKE DATA FOR AIRCRAFT Final Report
D. V. Giri, R. S. Noss, D. B. Phuoc, and F. M. Tesche Jun. 1983 205 p
(Contract NAS1-16893)
(NASA-CR-172127; NAS 1.26:172127) Avail: NTIS HC A10/MF A01 CSCL 04B

A method for interpreting direct strike and nearby strike lightning data on aircraft is discussed. The theoretical basis for the interpretation involves a transmission line model for the aircraft, and is discussed. Results of applying this model to the F-106 aircraft are presented and in the natural resonances are computed for several different electrical representations of the aircraft. The signal processing techniques useful for extracting pole (resonance) information from experimental data are discussed, and the use of these techniques on the measured lightning data is illustrated. Finally, the results of a related ground-based lightning experiment are discussed and data are presented. The purpose of this test was to gain additional understanding of the resonance properties of the F-106 aircraft. Author

N86-27856# Naval Postgraduate School, Monterey, Calif.
SYNOPTIC/MESOSCALE METEOROLOGICAL FEATURES IN THE MARGINAL ICE ZONE M.S. Thesis
Larry D. Phegley Dec. 1985 93 p
(AD-A165016) Avail: NTIS HC A05/MF A01 CSCL 04/2

This thesis summarizes meteorological conditions occurring in the Marginal Ice Zone Experiment (MIZEX-84), conducted in the East Greenland Sea during the summer of 1984. It includes a discussion of the synoptic and mesoscale conditions. The three cases discussed are: a weak storm which filled over the marginal ice zone (MIZ); an intense storm which transited the MIZ and entered the polar basin; and an undisturbed case. The MIZEX-84 period can be divided into three synoptic time periods. The first and the last were situations when the storms passed to the south and east of the Fram Striates. During the middle period the storms passed through the straits in response to the development of a closed upper-level low over the north coast of Greenland. Three of the four storms which moved into the straits were moving north-northwest and filled or slowed significantly in the MIZ. The fourth was moving parallel to the MIZ. This would seem to show that the MIZ does not dominate but may affect storm movement. GRA

N86-27857# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite Data and Information Service.
THE US WEATHER WATCH: A COMPOSITE SYSTEM Final Report
R. Koffler, E. Friday, Jr., F. Zbar, and J. Hussey Jul. 1985 24 p
(AD-A165072) Avail: NTIS HC A02/MF A01 CSCL 04/2

The U.S. Weather Watch observing system is a key element in monitoring local and global weather, and is essential to the provision of forecasts and services to the Nation. It has changed greatly over the past century, and its evolution over the next 15 years is expected to be even more rapid. This paper reviews those expected changes and other key NOAA programs. GRA

N86-27858# National Oceanic and Atmospheric Administration, Washington, D. C.
NUMERICAL WEATHER PREDICTION AND SATELLITE OBSERVATIONS Final Report
Frederick G. Shuman Aug. 1985 25 p
(AD-A165141) Avail: NTIS HC A02/MF A01 CSCL 04/2

The history of the scientific approach to weather forecasting is traced through the 20th century, including a projection to the year 2000. It is felt that such a review may foster a better understanding of the problems we face and will face in the future. During the first half of the century, little could be done, even on an experimental basis, because of the overwhelming need for tools that did not appear until midcentury. It is remarkable, however, that there were scientists who thought about weather forecasting in optimistic terms. There was a consistency throughout this preliminary period in determining exactly what was required for a successful beginning. It could not have been otherwise, because the natural laws dictate rather clearly these three requirements: (1) Sufficient observations of the atmosphere; (2) Sufficient knowledge of atmospheric mechanisms; (3) Sufficiently powerful means of computation. Solutions to these problems were adequately advanced by midcentury to allow the use of the scientific approach, but future advances must continue to be made to improve weather forecasting. Since 1960, observational weather satellites have played a large role in improving our ability to determine the initial state of the atmosphere, and they promise to play an ever larger role in the future. Author (GRA)

N86-27859# National Weather Service, Washington, D.C. Climate Analysis Center.
MONTHLY SEASONAL WEATHER OUTLOOK FOR APRIL, 1986, VOLUME 40, NUMBER 7, MARCH 29, 1986
29 Mar. 1986 10 p
(PB86-178266) Avail: NTIS HC A02/MF A01 CSCL 04B

Temperature and precipitation probabilities for the monthly and seasonal weather for North America are reported. GRA

N86-27860# National Weather Service, Salt Lake City, Utah.
WEATHER EXTREMES (7TH REVISION)
R. J. Schmidli Mar. 1986 26 p
(PB86-177672; NOAA-TM-NWS-WR-28) Avail: NTIS HC A03/MF A01 CSCL 04B

The purpose of the publication is to provide National Weather Service personnel with a ready reference of information that may be useful when preparing weather stories and radio scripts, when talking to mass-media reporters, and when answering questions from the general public. The memorandum is organized into fifteen categories covering the elements of temperature, precipitation, snowfall, atmospheric pressure, and wind. The fourteen western cities, thirteen western states, United States, North America, and world are each listed in the various categories. GRA

N86-27861# National Weather Service, Kansas City, Mo.
SEVERE THUNDERSTORM OUTBREAK OF JULY 6, 1983 IN SOUTHEAST IDAHO, WESTERN WYOMING AND SOUTHWEST MONTANA
G. L. Cox Apr. 1986 34 p
(PB86-184322; NOAA-TM-NWS-CR-81) Avail: NTIS HC A03/MF A01 CSCL 04B

Late in the afternoon on July 6, 1983, a squall line developed in southeast Idaho, the southwest corner of Montana, and northern Utah. The line of thunderstorms accelerated northeast through southwest Montana and into western Wyoming the rest of the afternoon and early evening before dissipating east of the Continental Divide. The thunderstorms generated wind gusts estimated up to 100 mph, did up to 1.5 million dollars of damage, and left one person dead and two injured. The following is a case study of that event, written from the point of view needed to forecast it. GRA

N86-27696# Meteorological Satellite Center, Tokyo (Japan).
ON THE Cb CLOUD VORTICAL PATTERN APART FROM TYPHOON PRESSURE CENTER
Shuhei Akashi, Hiroyuki Koba, and Michio Hitsuma *In its* Meteorological Satellite Center Technical Note, no. 13, 1986 (ISSN-0388-9653) Mar. 1986 p 33-56 IN JAPANESE; ENGLISH summary (For primary document see N86-27694 18-42)
Avail: NTIS HC A04/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N86-27862*# Woods Hole Oceanographic Institution, Mass.
HYDROGRAPHIC DATA FROM R/V ENDEAVOR CRUISE #90
M. D. Stalcup, T. M. Joyce, R. L. Barbour, and J. A. Dunworth Mar. 1986 82 p Sponsored in part by NSF
(Grants NAGw-272; NSF OCE-80-16983)
(NASA-CR-177234; NAS 1.26:177234; WHOI-86-15) Avail: NTIS HC A05/MF A01 CSCL 08C

The final cruise of the NSF sponsored Warm Core Rings Program studied a Warm Core Ring (WCR) in the Fall of 1982 as it formed from a large northward meander of the Gulf Stream. This ring, known as 82-H or the eighth ring identified in 1982, formed over the New England Seamounts near 39.5 deg N, 65 deg W. Surveys using Expendable Bathythermographs, Conductivity-Temperature-Depth-Oxygen stations and Doppler Current Profiling provide a look at the genesis of a WCR. These measurements reveal that WCR 82-H separated from the Gulf Stream sometime between October 2-5. This ring was a typical WCR with a diameter of about 200 km and speeds in the high velocity core of the 175 cm/sec. Satellite imagery of 82-H following the cruise showed that it drifted WSW in the Slope Water region at almost 9 km/day, had at least one interaction with the Gulf Stream and was last observed on February 8, 1983 at 39 deg N, 72 deg W. Author

N86-27863# Flow Research, Inc., Kent, Wash.
A HIGH-RESOLUTION CLUSTER OF OCEANOGRAPHIC INSTRUMENTS FOR BOUNDARY LAYER MEASUREMENTS UNDER ICE Final Report, 26 Sep. 1983 - 30 Nov. 1985
H.-T. Liu, J. J. Kolle, and P. D. Bondurant Nov. 1985 101 p
(Contract N00014-83-C-0764)
(AD-A165250; TR-352/11-85) Avail: NTIS HC A06/MF A01 CSCL 08/10

Three high-resolution clusters (HRCs) of oceanographic instruments, each consisting of three diode laser Doppler velocimeters (DLDVs), a high-frequency thermistor probe and a dual-electrode conductivity probe, have been developed for measurements of turbulent momentum, heat and mass fluxes in the oceanic boundary layer under ice. The spatial resolution was designed to be 2 cm or better. The DLDVs, which are the essential components of the HRCs, were first developed and successfully tested in the laboratory, then they were deployed during two field experiments. Two experimental units were deployed during the 1984 Marginal Ice Zone Experiment (MIZEX 84), and two prototype velocity-temperature-conductivity clusters were deployed during the 1985 Arctic Internal Wave Experiment (AIWEX 85). During-MIZEX 84, velocity components were measured simultaneously with the DLDV and ducted current meters. Good agreement was generally observed. The AIWEX 85 results also included temperature and conductivity measurements. Variations in temperature and conductivity at depths of 2 and 4 m were only observed with one sensor to exceed 0.01 C and 10 micromho/cm, respectively for a time scale up to one hour. This indicate that the boundary layer under the ice flow was essentially well-mixed, which is c onsistent with other observations during the same time period (April and May 1985). Both field experiments showed adequacy of scattering particles for use with the DLDV. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N86-27864*# Management and Technical Services Co., Washington, D.C.

USSR SPACE LIFE SCIENCES DIGEST, ISSUE 6
Lyida Razran Hooke, ed., Mike Radtke, ed., Ronald Teeter, ed., and Joseph E. Rowe, ed. Washington NASA Jun. 1986 131 p (Contract NASw-3676)
(NASA-CR-3922(07); NAS 1.26:3922(07)) Avail: NTIS HC A07/MF A01 CSCL 06C

This is the sixth issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 54 papers recently published in Russian language periodicals and bound collections and of 10 new Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. Additional features include a table of Soviet EVAs and information about English translations of Soviet materials available to readers. The topics covered in this issue have been identified as relevant to 26 areas of aerospace medicine and space biology. These areas are adaptation, biospherics, body fluids, botany, cardiovascular and respiratory systems, developmental biology, endocrinology, enzymology, exobiology, genetics, habitability and environment effects, health and medical treatment, hematology, human performance, immunology, life support systems, mathematical modeling, metabolism., microbiology, morphology and cytology, musculoskeletal system, neurophysiology, nutrition, perception, personnel selection, psychology, radiobiology, reproductive biology, and space medicine. Author

N86-27865# Electrotechnical Lab., Ibaraki (Japan).
STUDIES ON INFORMATION PROCESSING MECHANISMS IN THE CENTRAL VISUAL SYSTEM OF THE CAT
Shinji Kaji Dec. 1985 42 p
(EL-861; ISSN-0366-9106; UDC-572.788.916.3) Avail: NTIS HC A03/MF A01

The characteristics of information processing of visual neurons were investigated, including nonlinear summation and contour enhancement effects of concentric receptive fields, and neural interactions between detectors for the same or different stimulus domains. A model was proposed to explain the results of antagonistic actions between the center and surrounding regions in the concentric recptive field of lateral geniculate neurons. The response of lateral geniculate neurons with concentric receptive fields to large two-dimensional figures was investigated. The interactions between the different orientation detecting processes were investigated in the orientation sensitive neurons of the visual cortex. The neural interactions between two direction-selective processes as well as between direction and selective process were investigated in the complex type neurons, using a non-oriented textured stimulus (two-dimensional random noise pattern) and an oriented grating. B.G.

N86-27866# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
INHALATION TOXICOLOGY. 5: EVALUATION OF RELATIVE TOXICITY TO RATS OF THERMAL DECOMPOSITION PRODUCTS FROM TWO AIRCRAFT SEAT FIRE-BLOCKING MATERIALS Report, Oct. 1983 - Sep. 1984
Donald C. Sanders, Charles R. Crane, and Boyd R. Endecott Nov. 1985 16 p
(AD-A165034; DOT-FAA-AM-86-1) Avail: NTIS HC A02/MF A01 CSCL 06/20

Two fire-blocking layer (FBL) materials, designed to delay the thermal decomposition of polyurethane foam seat cushions during an aircraft cabin fire, were evaluated for the relative toxicity of their gaseous combustion products. Each materials was thermally decomposed under five distinct thermal environments: two contact temperatures (600 and 750 c) in a horizontal hot tube furnace and three flux levels (2.5, 5.0, and 7.5 w/cm) in a radiant heat furnace. The measured toxicological endpoint was time-to-incapacitation (+ sub i) in the albino rat; this endpoint is believed to be the most relevant one for assessing smoke hazard in a fire environment. In three of the five test environments, norfab, an aluminized synthetic fabric, produced shorter + sub i--and was thus toxic--than vonar, a neoprene foam. However, at 2.5 w/cm in the radiant furnace system, the norfab test specimen lost only 13 percent of the sample weight and did not incapacitate any of the test animals during the exposure period and, at 750c (flaming) in the combustion tube assembly, norfab produced longer and more variable + sub i than did vonar. Hydrogen cyanide (hcn) was detected in the combustion products from norfab under all test conditions except the 2.4 w/cm radiant flux level; no HCN was dtected in the test c onditions except the 2.5 w/+ sub i radiant flux level; no HCN was detected in the combustion products from any of the vonar tests. GRA

N86-27867# George Washington Univ., Washington, D.C.
MICROWAVE EFFECTS ON CNS: A HISTOPATHOLOGIC, ULTRASTRUCTURAL AND AUTORADIOGRAPHIC STUDY Final Report
Ernest N. Albert 20 Feb. 1986 69 p
(Contract N00014-78-C-0527)
(AD-A165040) Avail: NTIS HC A04/MF A01 CSCL 06/18

The objectives of this investigation were to: (1) investigate the effects of electromagnetic fields on the release of calcium ions from nervous tissue, (2) examine for histological changes, if any, of young rat brains after 2.45 GHz microwave exposure, and (3) study the rat brain metabolism during 2.45 GHz microwave exposure using 2-Deoxyglucose. In conclusion, the data presented here demonstrates that the specific radiofrequency radiation used does not perturb Ca ions efflux from avian brain tissue under in vitro conditions. Comparison of this data with that gathered by Blackman's group, however, suggests that appropriate radiofrequency radiation in conjunction with certain other physical factors may indeed perturb Ca ions efflux. GRA

N86-27868# Brookhaven National Lab., Upton, N. Y.
LATE BIOLOGICAL EFFECTS FROM INTERNAL AND EXTERNAL EXPOSURE
W. H. Adams 1985 12 p Presented at the Health Physics Society Symposium Hammond, La., 28 May 1985
(Contract DE-AC02-76CH-00016)
(DE86-001181; BNL-37087; CONF-8505213-1) Avail: NTIS HC A02/MF A01

Information on late biological effects of radiation was obtained from the long-term medical followup of a small population of Marshallese accidentally exposed to radioactive fallout from a thermonuclear test in 1954. Endocrine data are compatible with a sequence of nonstochastic radiation effects. The ingestion of radioisotopes of iodine produced clinical thyroid hypofunction in children, biochemical evidence of thyroid dysfunction in some adults, thyroid adenomatous module formation, and, as a possible indirect effect of thyroid damage, at least two cases of pituitary adenoma. In contrast, the only evidence of a stochastic effect has been a real increase in thyroid cancers among the more highly exposed people of Rongelap, none of whom have evidence of residual disease. While three nonthyroidal cancers which are known to be inducible in humans by external irradiation have been documented in the exposed population, three similar cancers have occurred in an unexposed comparison population of Marshallese. Nonstochastic effects of radiation exposure may be common but subtle. In the Marshallese experience the morbidity of delayed nonstochastic effects far exceeds that of the stochastic. DOE

N86-27869# Joint Publications Research Service, Arlington, Va.
USSR REPORT: LIFE SCIENCES. BIOMEDICAL AND BEHAVIORAL SCIENCES
9 May 1986 143 p Transl. into ENGLISH from various Russian articles
(JPRS-UBB-86-008) Avail: NTIS HC A07/MF A01

Topics on life sciences addressed include: aerospace medicine, agrotechnology, biochemistry, biophysics, biotechnology, epidemiology, food technology, genetics, human factors engineering, immunology, clinical medicine, microbiology, physiology, public health, psychology, radiation biology, and virology. For individual titles, see N86-27870 through N86-27877.

N86-27870# Joint Publications Research Service, Arlington, Va.
LACTOBACTERIA AND PROPHYLAXIS IN SPACE c52
I. Ivanov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 1 Transl. into ENGLISH from Tass (Tartu, USSR), 11 Mar. 1986 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

Cosmonauts on long duration space flights face health hazards in the form of pathogenic bacteria. Lactobacteria increase the resistance of the body to disease and kill agents responsible for many diseases. The lactobacteria have the capacity to stick to the cell of the human body and thus make them invulnerable to pathogenic microbes. The lactobacteria preparation replenishes the loss of the bacteria in the human body and stimulates the immune system. The use of these microorganisms institutes an ecological barrier protecting man. B.G.

N86-27871# Joint Publications Research Service, Arlington, Va.
COMMENTARY ON RESULTS OF BIOLOGICAL SATELLITE PROGRAM
Yu. Fabbishenko *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 2 Transl. into ENGLISH from Meditsinskaya Gazeta (Moscow, USSR), 15 Jan. 1986 p 4 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

The Kosmos-1667 satellite carried two monkeys and other biological specimens. The experimental animals were employed to gather scientific data which is difficult or impossible to obtain from human subjects. The monkeys were monitored with 20 sensors and provided data on the mechanism of changes in an organism during the period of acute change. B.G.

N86-27872# Joint Publications Research Service, Arlington, Va.
SWEATING REFLEX IN COMPLEX OF METHODS FOR EVALUATING OPERATOR EFFICIENCY c52
P. P. Slynko, L. I. Bukvareva, S. V. Zaporozhets, and P. M. Onishchenko *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 46 Transl. into ENGLISH from Fiziologicheskiy Zhurnal (Kiev, USSR), v. 31, no. 6, Nov. - Dec. 1985 p 678-682 Original language document was announced as A86-21453 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

A method for measuring the electrodermal characteristics associated with the stress induced diaphoretic reflex was developed. The method is intended for use in evaluating the functional conditions of a human operator in monotonous work conditions. A general description of the diaphoretic skin sensor is give, and experimental results are presented concerning the accuracy of the method in comparison to conventional electrodermal sensing methods. It is shown that, in contrast to conventional methods, the present sensing method offers a highly reliable measure of skin response over extended periods of monotonous work.
I.H.(IAA)

N86-27873# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF SHIPBOARD ENVIRONMENTAL FACTORS ON CONDITIONED REFLEX ACTIVITY OF EXPERIMENTAL ANIMALS DURING A LONG VOYAGE
O. Yu. Netudykhatka, A. P. Stoyanov, and V. N. Yevstafyev *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 98 Transl. into ENGLISH from Fiziologicheskiy Zhurnal (Kiev, USSR), v. 31, no. 6, Nov. - Dec. 1985 p 688-691 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

The influence of environmental factors encountered on board a ship, with predominance of the noise vibration component, was studied with the conditioned reflex activity of experimental animals. Experiments were performed on 120 male Wistar white rats during a 90-day voyage of a freighter. The influence of specific shipboard environmental factors was evaluated on the basis of studies on conditioned motor reflexes involving response to a sound signal which preceded application of a mild electric shock by 5 seconds. The changes in the conditioned reflex activity varied with intensity and duration of training. Differences in the avoidance reaction were observed in all groups of animals, indicating an increase in the degree of inhibitory processes in the central nervous system as a result of the influence of the unfavorable sanitary-hygienic factors characteristic for the working spaces in ships. Author

N86-27874# Joint Publications Research Service, Arlington, Va.
EFFECTS OF COLD EXPOSURE ON THERMAL STATUS OF MEN AND WOMEN c52
R. F. Afanasyeva and R. O. Oganyan *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 100 Transl. into ENGLISH from Gigiyena Truda i Professionalnyye Zabolevaniya (Moscow, USSR), no. 1, Jan. 1986 p 24-28 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

Sex differences in thermal confort perception and objective changes in skin temperature and heat loss on exposure to different environmental temperatures were assessed in 8 men and 9 women between the ages of 20 and 35 years. In conjecture with the objective data that thermoregulation in women relies essentially on physical factors (decreased skin temperature and diminished body heat loss), women were quicker to perceive thermal discomfort. In men, thermal homeostasis relied preferentially on chemical thermoregulation reflected in greater heat loss. B.G.

N86-27875# Joint Publications Research Service, Arlington, Va.
STUDY OF BRAIN BIOCHEMISTRY DURING HYPOTHERMIA c52
E. E. Emirbekov and S. P. Lvova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 101 Transl. into ENGLISH from Kriobiologiya (Kiev, USSR), no. 1, 1985 p 44-49 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

Aspects of cerebral metabolism in hibernating and non-hibernating animals during hypothermia are discussed and analyzed on the basis of literature survey. Existing factual materials on neurochemical changes in the brain due to hypothermia cannot support formulation of a fully developed theory of the effect of cooling on cerebral metabolism. There are many gaps in the area of neuro-specific components and their role in hypothermia. A specific concept of the effect of hypothermia on molecular processes in the brain is described briefly. Existence of reserve possibilities of regulatory processes in the central nervous system during hypothermia is indicated and prospects are presented for extending resistance of warm blooded animals to hypothermia by use of adaptive functions at low body temperatures. Author

N86-27876# Joint Publications Research Service, Arlington, Va.
SOMATOSENSORY AND AUDITORY PERCEPTION ACCORDING TO STUDY USING FOCUSED ULTRASOUND c52
Ye. M. Tsirulnikov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 102 Transl. into ENGLISH from Zhurnal Evolyutsionnoy Biokhimii i Fiziologii (Leningrad, USSR), v. 21, no. 6, Nov. - Dec. 1985 p 591-596 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

Materials from literature are used in discussion of aspects of the interpenetration of physiology and psychology in the area of sensory preception with emphasis on the contribution of somatosensory and auditory systems with the aid of focused ultrasound. Characteristics of distribution of sensitivity in the skin surface and in deep tissues are described and discussed. Specific feature of sensitivity in biologically active points are considered. The advisability of isolating elementary sensation and considering its role in formation of a sensory image was indicated. Artificial formation of samples, especially single-model samples such as tactile, temperature or auditory modes was found to be helpful since such a model can be controlled to a great degree with the aid of focused ultrasound and other artificial stimuli. Author

N86-27877# Joint Publications Research Service, Arlington, Va.
CHANGE OF RNA AND PROTEIN LEVEL IN NEURONS-GLIA

SYSTEM UNDER EFFECTS OF HYPERTHERMIA AND HYPOXIA

L. M. Mamalyga *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 103 Transl. into ENGLISH from Izvestiya Akademii Nauk Moldavskoy SSR. Seriya Bioilogicheskikh i Khimicheskikh Nauk (Kishinev, USSR), no. 5, Sep. Oct. 1985 p 42-47 (For primary document see N86-27869 18-51)

Avail: NTIS HC A07/MF A01

Functional and metabolic possibilities of different brain structures, under the effects of hyperthermia, hypoxia, and combinations of both, were studied by cytochemical and morphological methods in experiments performed on Wistar male white rats (weight 160 to 180 g) (age 5 to 6 months). Rats were subjected to simulated altitude of 8200 m, to hyperthermia at 40 C for 75 minutes, or to combined hyperthermia and hypoxia at 8200 m and 40 C for 75 minutes. After the experiment, rats were decapitated without use of anesthesia and RNA level and total and basic proteins in various neuron-glia systems were studied. Separate and combined effects of hyperthermia and hypoxia in the organism produced metabolic and morpholocigal changes in the brain structures studied. Reduction of RNA level and proteins in the neurons under combined effect of hyperthermia and hypoxia decreased their cytoplasm volume; overheating dehydrated the organism, reduced the volume of circulating blood, increased its viscosity, and reduced the hemoglobin level in the erythrocytes. The combined effect of hyperthermia and hypoxia, increasing at different rates, decreased the resistance of the animal to altitude considerably. Author

N86-27878# Joint Publications Research Service, Arlington, Va.

USSR REPORT: SPACE BIOLOGY AND AEROSPACE MEDICINE, NO. 1, JANUARY - FEBRUARY 1986

17 Apr. 1986 161 p Transl. into ENGLISH of Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), no. 1, Jan.-Feb. 1986 94 p

(JPRS-USB-86-003) Avail: NTIS HC A08

Presented is the translation of a journal on space biology and aerospace medicine published in the USSR. The journal is divided into areas of surveys, experimental and general theoretical research, methods, and brief reports. Some representative topics are: Prospects for using ultraviolet radiation in long term spaceflights; Some human reactions during seven-day antiorthostatic hypokinesia; Effect of diphosphonates on bones of hypokinetic rats; Effect of different doses of ultraviolet radiation on vitamin levels in man; Reproductive capacity of microflora on polymers used in sealed environments; and amino acid spectrum of human blood in the presence of emotional stress. For individual titles, see N86-27879 through N86-27904.

N86-27879# Joint Publications Research Service, Arlington, Va.

PROSPECTS FOR USING ULTRAVIOLET RADIATION IN LONG-TERM SPACEFLIGHTS c52

N. Ye. Panferova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 1-13 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 4-12 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

The data concerning UV-effects on the human body and the environment are reviewed as applied to long term flights. It is concluded that UV-radiation can be used in long term spaceflights in view of its vitamin forming, desensitizing, bactericidal and supporting properties to improve the environment and to prevent adverse effects of spaceflight factors. Author

N86-27880# Joint Publications Research Service, Arlington, Va.

EXPERIMENTAL AND GENERAL THEORETICAL RESEARCH: NATURE OF CIRCULATORY REGULATION IN PILOTS c52

V. G. Doroshev, Z. A. Kirillova, and A. P. Vanarshenko *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 14-18 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 12-15 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

Dynamic observations over a group of pilots within a working week during three months have shown that blood pressure increases to meet the requirements via higher cardiac output. When stresses grow and fatigue sets in, the pattern of circulation regulation changes so that elevated blood pressure is maintained due to an increased peripheral resistance. Differential approach to the pattern of blood pressure regulation makes it possible to assess the degree of circulation adaptation to various work loads. Author

N86-27881# Joint Publications Research Service, Arlington, Va.

PSYCHOEMOTIONAL PILOT STRESS PRIOR TO EJECTION AND ITS ROLE IN APPROPRIATE PERFORMANCE c53

A. P. Kozlovskiy and A. F. Kovalenko *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 19-24 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 16-19 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

It was demonstrated that with respect to the psychoemotional state real and simulated catapulting events were similar. The time-course variations in the latent period of the motor reaction were obtained. The time interval between the command Go and the catapulting event was found to increase significantly in relation to the latent period. This was correlated with the level of psychoemotional strain. Author

N86-27882# Joint Publications Research Service, Arlington, Va.

EFFECT OF INTENSIVE OPERATOR WORK ON LIPID PEROXIDATION PROCESSES IN MAN c52

S. M. Ivanova, O. N. Orlov, S. S. Brantova, O. I. Labetskaya, N. A. Davydova, A. Ye. Zezerov, and A. S. Ushakov *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 25-28 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 20-22 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

It was demonstrated that the stress associated with an active mental work for 2 hours leads to a high rate of lipid peroxidation which results in a greater amount of products of lipid peroxidation in blood and pentane in exhaled air. Simultaneous measurements of blood catecholamines have shown their significant increase immediately after exposure to the stress effect. It can therefore be concluded that a stress situation enhances lipid peroxidation in the human body. Author

N86-27883# Joint Publications Research Service, Arlington, Va.

EFFECT OF RHYTHMIC PHOTIC INTERFERENCE ON WORKING ELECTROENCEPHALOGRAM AND EFFICIENCY OF HUMAN MOVEMENTS c53

Ye. T. Petrenko and L. A. Yermukhametova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 29-33 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 22-25 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

The effect of rhythmic light flashes on the space-time pattern of brain biopotentials during motor functions and biomechanical efficiency of man's actions was investigated. As the motor model, the ability to maintain equilibrium when standing on the toes of one foot was used. Electroencephalography (EEG) from 12 neocortical areas and oscillations of the body mass center (stabilography) were recorded in 20 men who performed the exercise under normal conditions and during light flashes of 12 Hz. The resultant EEG and stabilograms were exposed to correlations-spectral and coherent analysis with the aid of an EC-1035 computer. Light flashes induced a change in the EEG peaks and

flicker fusion frequency, a significant increase of the density of biopotentials corresponding to the light stimulation frequency, and a redistribution of the number of high intercentral correlations between neocoretical motor centers. When the light flashes were presented, 75 to 85% of the test subjects showed a 0.19 to 0.26 increase in the biopotential coherence of the premotor, motor and sensomotor areas. They also exhibited a significant decrease in the body stability and an increase in the stabilographic amplitude and frequency. It is suggested that the decline of biomechanical efficiency is associated with the disorders of the space-time integration between neocortical centers involved in the motor control system that are responsible for the execution of motor acts. Author

N86-27884# Joint Publications Research Service, Arlington, Va.
DISTINCTIONS IN HUMORAL CONTROL OF METABOLISM WITH SIMULATION OF SPACEFLIGHT FACTORS **c52**
S. Kalandarov, V. P. Bychkov, I. D. Frenkel, and G. I. Proskurova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 34-38 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 25-28 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

Hormonal regulation of metabolism was investigated in test subjects of three age groups: group 1 included test subjects of 41 to 50 years old, group 2 test subjects of 50 to 57 years old, and group 3 test subjects of 26 to 33 years old. Test subjects from groups 1 and 2 were exposed to head down tilt as well as linear acceleration of 3 Gz for 1 min and exercises of 450 to 1050 kgm before and after the tilt test. Group 3 test subjects were exposed to neuroemotional stress before, during and after the head down test. Exposure to head down tilt, acceleration and exercises caused adaptive changes in humoral regulation of metabolism in the test subjects of groups 1 and 2. Food supplements given to group 3 test subjects produced a normalizing effect on humoral regulation of metabolism. Author

N86-27885# Joint Publications Research Service, Arlington, Va.
SOME HUMAN REACTIONS DURING 7-DAY ANTIORTHOSTATIC HYPOKINESIA **c52**
B. F. Asyamolov, V. S. Panchenko, V. A. Karpusheva, R. A. Bondarenko, O. A. Vorobyev, V. V. Zaritskiy, V. P. Stupnitskiy, I. G. Popov, P. A. Lozinskiy, and S. M. Ledovskoy *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 39-44 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 29-32 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

Time-course variations in the cardiovascular parameters, vestibulo-autonomic stability, work capacity and nutritional status were measured in 20 male test subjects, aged 19 to 22, who were exposed for 7 days to head down tilt. Beginning with days 3 or 4, new hemodynamic ratios developed that indicated a new level of circulation regulation and adaptation to head down tilt. It appears that blood redistribution towards the head led to an enhanced vestibulo-autonomic stability. Renal excretion of nitrogen increased, reaching the highest level on days 6 to 7. The investigations allow the conclusion that 7-day head down tilt may cause changes in almost every physiological system. Author

N86-27886# Joint Publications Research Service, Arlington, Va.
COLLAGEN, LIPID AND GLYCOGEN CONTENT OF RAT SKELETAL MUSCLES IN RECOVERY PERIOD AFTER 15- AND 30-DAY HYPOKINESIA
P. P. Potapov *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 45-48 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 33-35 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

On the 15th hypokinetic day, carcass mass, glycogen and lipid content in skeletal muscles decreased while collagen content increased. The content of collagen returned to the norm by the 7th day of the recovery period. By that time the glycogen content increased significantly and a week later decreased noticeably. The content of total lipids and triglycerides was higher than the baseline level on the 15th and 30th days of the recovery period. On hypokinesia day 30 carcass mass and glycogen content decreased while collagencontent increased. After 30-day hypokinesia, glycogen significantly increased on the 7th day and returned to the norm by the 60th day of the recovery period. Lipid content was elevated only on the 7th day of the recovery period, and collagen content returned to the norm on the 15th day of the recovery period. Following 15- and 30-day hypokinesia, carcass mass returned to the baseline level by the 30th day of the recovery period. Author

N86-27887# Joint Publications Research Service, Arlington, Va.
HUMAN CENTRAL HEMODYNAMICS DURING LOWER LIMB DECOMPRESSION **c52**
V. V. Rumyantsev and V. Ye. Katkov *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 49-52 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 35-37 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

Experiments were performed to study the effect of leg decompression in the head down position at -15 deg. The method of chronic catheterization was used, pressure was measured in different areas of the cardiovascular system, blood was withdrawn for biochemical analysis. The effect of leg decompression was compared with that of lower body negative pressure. Decompression produced changes in Pressure in Pulmonary (PAP) and Central Venous Pressure (CVP) that were similar in sign but different in magnitude. The decompression induced changes in PAP and CVP were primarily determined by the area of exposure. Using previous data, a nomograph was constructed to evaluate PAP and CVP variations as a function of the decompression mode and site. Author

N86-27888# Joint Publications Research Service, Arlington, Va.
PHASIC PROCESSES IN KINETICS OF FORMED BLOOD ELEMENTS **c52**
V. V. Verigo and F. Gauser *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 53-58 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 38-41 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

When quantitating blood shifts in response to environmental effects, it is important to take into account the phasic pattern of certain processes. Theoretical considerations and experimental data on the fluctuations of the counts of formed elements have been published. Since the fluctuations cannot be easily detected by experimental methods, they can be investigated using mathematical modeling. A model describing the counts of red blood cells and their precursors in relation to the age structure of the population was developed. Depending on the oxygen requirements and physiological parameters, humoral regulation controls cell proliferation and release into the functioning pool. The model allows for incidental hemolysis as well as for lifetime of red blood cells. Simulation of various processes in the blood system when exposed to unusual environmental effects has shown that some of the processes can be phasic in character. Author

N86-27889# Joint Publications Research Service, Arlington, Va.
MORPHOLOGICAL AND BIOCHEMICAL INVESTIGATION OF RAT ADRENOCORTICAL FUNCTION DURING LONG-TERM HYPOKINESIA
Ye. V. Vorotnikova and Ye. A. Zagorskaya *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February

1986 (JPRS-USB-86-003) 17 Apr. 1986 p 59-65 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 41-45 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

Female rats exposed to 3-month hypokinesia were used to study adrenal morphology and plasma corticosterone. Prolonged hypokinesia (60 to 90 days) led to a dissociation between adrenal hypertrophy and lower corticosterone content in plasma. During hypokinesia, rats were also exposed to an additional stress effect, i.e., 5-hour immobilization. This approach showed that in the course of 90-day hypokinesia the adrenal cortex retained its ability to react to an acute stress by an enhanced corticosteroid secretion. Moreover, in response to stress effects of identical strength and duration the experimental adrenals produced more corticosterone than the controls with no structural rearrangement or delipoidization. Author

N86-27890# Joint Publications Research Service, Arlington, Va.
EFFECT OF DIPHOSPHONATES ON BONES OF HYPOKINETIC RATS
V. N. Shvets, A. S. Pankova, O. Ye. Kabitskaya, Z. Ye. Vnukova, and B. V. Morukov *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 66-72 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 45-49 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

The diphosphonate effect on bones was studied in Wistar male rats weighing about 200 g. The rats were kept for 60 days in small size cages where their motor activity was diminished. Every day the rats were given 0.3% solution of 1-hydroxy-ethylene-1,1-diphosphonate (HEDP) containing 9 mg/kg phosphorus. In the course of hypokinetic exposure the rats developed generalized osteoporosis. Histomorphometric measurements demonstrated that the drug did not prevent mineral losses from the tubular bones (humerus, femur). However, the drug led to a complete bone mass recovery in the pelvix and a partial recovery in the sternum. The drug also produced a preventive effect on the population of cells-precursors of osteogenesis, the number of which decreases significantly during hypokinesia. Author

N86-27891# Joint Publications Research Service, Arlington, Va.
EXPERIMENTS WITH DEVELOPING PLANTS ABOARD SALYUT-5, SALYUT-6 AND SALYUT-7 ORIBITAL STATIONS
L. N. Kostina, I. D. Anikeyeva, and E. N. Vaulina *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 73-78 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 53-56 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

The experiments with air dry Crepis capillaris seeds flown on the spacecraft Soyuz-16 and orbital stations Salyut-5, Salyut-6 and Salyut-7 showed that the number of aberrant cells in the seedlings grown during flight (experimental) and after flight (flight control) was higher than in the ground based control. This number was greater in the experimental seedlings than in the flight controls. The plants Arabidopsis thaliana grew from cotyledons to flowers during flight. The seeds developed postflight exhibited a lower fertility and a higher frequency of recessive mutants. The greater number of mutants persisted in the progeny of plants that completed their developmental cycle. Inhibited viability of germs manifested as a reduced germination rate of flown seeds and a premature death of seedlings. In the first postflight generation the lesions produced by large chromosome aberrations were eliminated and the lesions caused by gene mutations and microaberrations were retained. Author

N86-27892# Joint Publications Research Service, Arlington, Va.
T AND B COMPONENTS OF IMMUNITY IN THE PRESENCE OF ACUTE MOUNTAIN SICKNESS **c52**
M. M. Mirrakhimov, M. I. Kitayev, R. O. Khamzamulin, A. G. Tokhtabayev, and S. M. Pogrebitskiy *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 79-84 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 53-56 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

Immunological aspects of the adaptation process were investigated in 57 male test subjects that stayed for 30 days at an altitude of 3600 m above sea level. The uneventful development of adaptation was accompanied by a short term decrease in the number and activity of T-lymphocytes. An acute mountain disease led to a distinct deficiency of T-cell immunity which still persisted on test day 30. Besides, the content of zero cells in circulating blood was increased and the blast-transformation reaction of lymphocytes to concavalin A was inhibited. Prior to the ascent the test subjects who were susceptible to the acute mountain disease showed a lower content of T-lymphocytes and a higher content of zero cells in circulating blood. Author

N86-27893# Joint Publications Research Service, Arlington, Va.
EFFECT OF DIFFERENT DOSES OF ULTRAVIOLET RADIATION ON VITAMIN LEVELS IN MAN **c52**
M. S. Belakovskiy, M. G. Yuzhanskaya, N. Ye. Panferova, L. Kh. Pastushkova, O. G. Pereverzeva, A. N. Smirnova, I. N. Sergeyev, and V. B. Spirichev *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 85-91 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 56-61 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

Exposure of healthy adults to prophylactic doses of UV radiation in the medium and long wavelength spectrum improved metabolism of vitamins A, E and D and increased their content in the body. UV irradiation even in prophylactic doses increased ascorbic acid requirements. Excessive UV radiation produced an adverse effect on the vitamin content. However, the vitamin concentration in blood was not significantly decreased. This can be explained by the adaptation of the human body to UV-irradiation upon a continuous increase of its dosage. Author

N86-27894# Joint Publications Research Service, Arlington, Va.
PHYSICAL ENDURANCE OF RATS DURING INTENSIVE AND REPEATED EXPOSURE TO STATIONARY MAGNETIC FIELD
L. V. Kokoreva *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 92-94 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, Jan. - Feb. 1986 p 61-63 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

Variations in physical endurance of rats exposed to a constant magnetic field of 1.6 T for 3 hours a day during 30 days were investigated. The parameter was measured as the time of swimming with a load making 10% of body weight until complete arrest. The rats exposed once, 5 or 15 times showed a longer time of swimming than the controls. On the 30th day of exposure there was no difference between the experimental and control animals. The data obtained suggest that exposure to a constant magnetic field produces a stimulating effect on physical work capacity during the first 15 days. Author

N86-27895# Joint Publications Research Service, Arlington, Va.
RADIOBIOLOGICAL VALIDATION OF QUALITY FACTOR OF PROTONS AND HELIUM IONS **c52**
N. I. Ryzhov and B. S. Fedorenko *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 95-99 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, Jan. - Feb. 1986 p 63-66 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

Reported data and experimental results of measuring the relative biological effectiveness of protons of different energies and helium ions of 4 GeV/nuclon were analyzed to determine quality factors of the major components of cosmic radiations. It is recommended to use quality factors equal to 1.30 to 1.45 for 100 to 730 MeV protons and equal to 1.75 for 9 GeV protons and 4 GeV/nuclon helium ions. It is also suggested to employ them as standards for solving practical problems of radiation safety in spaceflights.

Author

N86-27896# Joint Publications Research Service, Arlington, Va.
EFFECT OF DIBASOL AND SOME OF ITS IMIDAZO ANALOGUES ON ANIMAL TOLERANCE TO GRAVITATIONAL ACCELERATIONS AND DYNAMICS OF DEVELOPMENT OF POSTISCHEMIC CEREBROVASCULAR PHENOMENA

V. K. Vereshchagin and M. D. Gayevyy *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 100-105 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 67-70 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

Anesthetized and nonanesthetized animals were used to study the effect of dibazolum and its new imidazo analogs (designated AKS-67 and AKS-87) on animal tolerance to gravitational effects and cerebral ischemia (ligation of both carotid arteries), as well as on systemic arterial pressure and tone of cerebral and peripheral vessels (resistographically) in the postischemic period. The drugs were administered 30 to 90 min before exposure. It was found that in nonanesthetized rats dibazolum and AKS-87 increased tolerance to cranio-caudal acceleration and decreased it to caudo-cranial acceleration, whereas AKS-67 produced a distinct protective effect regardless of the vector. In anesthetized rats (bilateral carotid ligation) AKS-67 and AKS-87 increased acceleration tolerance and dibazolum produced no protective effect. Dibazolum enhanced postischemic hypotension while AKS-67 and AKS-87 delayed or completely arrested it. For aerospace medicine the drug AKS-67 is of particular importance because it increases significantly animal tolerance to acceleration and stabilizes arterial pressure in the postischemic period. Author

N86-27897# Joint Publications Research Service, Arlington, Va.
REPRODUCTIVE CAPACITY OF MICROFLORA ON POLYMERS USED IN SEALED ENVIRONMENTS

N. D. Novikova, M. I. Orlova, and M. B. Dyachenko *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 106-109 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 71-73 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

The main representatives of human automicroflora were examined to identify the microorganisms that can grow and develop on various polymers used in an enclosed interior. Bacteria of the genera Pseudomonas, Proteus and Bacillus were found to be most proliferative. Microbial growth was strongly influenced by environmental parameters of the enclosure and by the chemical structure of the polymer. Author

N86-27898# Joint Publications Research Service, Arlington, Va.
RESTRAINT SYSTEM FOR WAKING MACACA MULATTA MONKEYS DURING POSTURAL TESTS

V. P. Melnichenko, M. D. Goldovskaya, V. P. Kotov, A. G. Popov, I. S. Kondakova, and N. V. Gorbatenkova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 110-112 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 73-74 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

Postural tests are a convenient model for investigation of the distinctions in physiological functions with changes in body position in relation to the vector of Earth's gravity. Postural tests are difficult to perform on waking Macaca mulatta monkeys because of their general motor activity, the level of which depends largely on how the animals are immobilized on the turntable. A restraint system involving the use of a special suit is known. The results of the observations revealed that the system of immobilization must meet the following requirements: it should not cause any pain to the animal and must reduce to a minimum the effect of factors that elicit discomfort; it must provide for a standard position of the monkey on the turntable platform; it must prevent passive displacement of the monkey under the effect of gravity when the turntable is tilted. For this reason, a restraint system was developed, the principal elements of which are an immobilization suit, a device that restricts head movements, a device that restricts the monkey's body movements in orthostatic position. The above system was used in postural tests on monkeys weight 3.5 to 6 kg. The system provided reliable, sparing immobilization of monkeys on the turntable and was convenient to work with. E.R.

N86-27899# Joint Publications Research Service, Arlington, Va.
METHOD OF DEMONSTRATING CALCIUM IN HUMAN FOOT BY NEUTRON ACTIVATION OF (ALPHA, N)-SOURCES c52

V. Ye. Zaychik, A. Ye. Kondrashov, and B. V. Morukov *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 113-119 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, Jan. - Feb. 1986 p 75-78 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

Bone demineralization during long term exposure to weightlessness and hypokinesia is presently a universally recognized fact. However, it should be noted that quantitatively incomparable results were obtained with use of different methods (X-ray densitometry, photon absorptiometry, X-ray tomography) to determine mineralization of bone. Evidently, this is attributable to the fact that they yield only an indirect estimate of the state of the mineral matrix of bone, since they characterize a parameter inherent in bone tissue as a whole, namely, the degree of absorption of photons of X-ray and gamma ranges of energy. Availability of this information alone does not allow one to draw a strictly quantitative conclusion about one of the important features of the mineral matrix, the concentration of calcium. Recording mesoroentgen radiation during exposure of some parts of the skeleton, for example, the calcaneus, to mu-mesons is a promising procedure for development of a method of direct measurement of the main mineral constituents of bone. However, there is still much to be done in this direction, and it is difficult to execute such a measuring method, as well as to make a quantitative interpretation of the obtained results. A description of the in vivo NAA method for Ca level in the human foot is presented. Special investigations had to be conducted to optimize irradiation conditions and spectrometry, as well as develop special equipment, in order to reach the goal of no more than 0.05 relative total error of each individual measurement with an equivalent dose or no more than 3 rem. E.R.

N86-27900# Joint Publications Research Service, Arlington, Va.
DIRECT SPECTROPHOTOMETRIC METHOD OF ASSAYING AMMONIA CONCENTRATION IN GAS ENVIRONMENT OF SEEDING CHAMBERS

A. A. Polovinkin and A. N. Kravchuk *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 120-122 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, Jan. - Feb. 1986 p 78-80 (For primary document see N86-27878 18-51)

Avail: NTIS HC A08

Toxicologists have been traditionally using colorimetry methods to measure ammonia concentration in the air environment. Colorimetric methods are simple to use, they have rather high sensivity and accuracy. However, they also have a number of flaws. Use of a spectrophotometric method of assaying ammonia in an air environment eliminates these flaws. A combined unit was developed and used for measurement of ammonia concentra-

tion in the range of 1 to 150 mg/cu m in the atmosphere of seeding chambers in toxicological experiments. The method is based on using the absorption maximum of ammonia at a wavelength of 204.3 mm. Introduction of the device to practical toxicological studies makes it possible to effect continuous monitoring, recording and correction of ammonia content of seeding chambers. E.R.

N86-27901# Joint Publications Research Service, Arlington, Va.
AMINO ACID SPECTRUM OF HUMAN BLOOD IN THE PRESENCE OF EMOTIONAL STRESS c52
T. F. Vlasova, A. S. Ushakov, V. P. Bychkov, and Ye. B. Miroshnikova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 123-125 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 80-82 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

The results of assaying the amino acid spectrum of human blood with simulation of stress situations similar to the professional activities of cosmonauts are presented. Methods and results are discussed. Author

N86-27902# Joint Publications Research Service, Arlington, Va.
BLOOD SERUM ENZYMES DURING 7-DAY WATER IMMERSION c52
T. Ye. Drozdova and Ye. G. Vetrova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 126-128 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 82-83 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

During submersion in water the body is exposed to a number of factors, among which redistribution of blood and lack of load on the locomotor system are rather important. This could affect metabolism of skeletomuscular tissue and parenchymatous organs, analogous to the effect of weightlessness. Investigation of changes in blood serum enzyme spectrum enables the demonstration, with some degree of certainty, the direction of metabolic transformations in different tissues and organs in weightlessness. Author

N86-27903# Joint Publications Research Service, Arlington, Va.
INTENSITY OF PHOTOSYNTHESIS IN CLOSTERIOPSIS ACICULAR VAR. AFRICANA HIND AS A FUNCTION OF OXYGEN CONCENTRATION IN THE ATMOSPHERE
M. A. Levinskikh *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 129-131 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 83-84 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

When unicellular algae are included in the photoautotrophic link of closed ecological systems, it is important to know their attitude toward different concentrations of oxygen in the atmosphere. The adverse influence of high concentrations of oxygen on photosynthesis is known as the Warburg effect. The inhibitory effect of high oxygen content on photosynthetic productivity of algae referable to different taxonomic groups has been repeatedly confirmed by many authors. In particular, for a number of Chlorella strains it was shown that intensity of photosynthesis, in the case of both cumulative and continuous long term cultivation, is directly related to concentration of oxygen in the gas phase. At the same time, there is information to the effect that some algae can retain productivity when partial oxygen pressure is raised both in the range of 3 to 5 to 21% and up to 40 to 80%. Finally, it was established that the photosynthetic process in Chlorella sorokiniana ORS is resistant to oxygen concentrations in the atmosphere of up to 95%. The intensity of photosynthesis in Closteriopsis acicularis var. africana Hind., family Ankistrodesmaceae, as a function of oxygen concentration in the reactor's gas phase was investigated. Author

N86-27904# Joint Publications Research Service, Arlington, Va.
RADIOPROTECTIVE AND THERAPEUTIC EFFICACY OF CARRAGEENAN AGAINST PROTON RADIATION c52
K. S. Chertkov, N. I. Gvozdeva, B. S. Fedorenko, and Yu. Yu. Preobrazhenskiy *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 132-135 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 84-86 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

Assurance of radiation safety of long term spaceflights is one of the important tasks put to space biology and medicine. In this regard, importance is attributed to refinement of technical equipment, search and development of effective drugs. It is known that the danger of irradiation, mainly from high energy protons, is higher in long term spaceflights. It was deemed desirable to investigate the radioprotective properties of some previously tested radioprotective agents, for example, carrageenan, during exposure to protons. E.R.

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

N86-27905* National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Dec. 1985 81 p
(NASA-SP-7011(278); NAS 1.21:7011(278)) Avail: NTIS HC A05 CSCL 06E

This bibliography lists 237 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1985. Author

N86-27906# Electrotechnical Lab., Ibaraki (Japan).
STUDIES ON VISUAL INFORMATION PROCESSING IN RETINAL NEURONS
Masahiro Yamada Oct. 1985 78 p In JAPANESE; ENGLISH summary
(EL-859; ISSN-0366-9106; UDC-612.843:681.3) Avail: NTIS HC A05/MF A01

In the retina a great deal of information is processed. A negative feedback hypothesis in synaptic mechanisms explaining color information processes in retinal neurons was not proved physiologically in spite of being supported by histological findings. In order to know the characteristics of visual information processing, the relationship between photostimulus and electric response of cells, particularly, the response dynamics was investigated. A linear response analysis method was applied to the neural network in a retina. The effects of light adaptation on the waveforms of oscillatory potentials found in photoresponses of rods were examined. The relationship between rod and cone neural pathways was studied. The responses of second neurons to photostimulus at receptor cells was also examined. B.G.

N86-27907# Electrotechnical Lab., Ibaraki (Japan).
STUDIES ON ACCURATE MEASUREMENTS AND ANALYSES OF HUMAN OLFACTORY EVOKED POTENTIALS
Mitsuo Tonoike Jan. 1986 86 p In JAPANESE; ENGLISH summary
(EL-863; ISSN-0366-9106; UDC-612.86:6512.825.5:159.933) Avail: NTIS HC A05/MF A01

Several techniques were developed to measure human olfactory evoked potentials (OEPs). Waveforms of the OEPs were recorded when perceived. Techniques for rejecting the contaminants and preventing various kinds of noise are described. The

saturation phenomenon is discussed with respect to the amplitude of OEPs for repeated pulse stimuli. Psychological studies on the scaling structure of odors were performed to compare the waveforms of OEPs with the psychological data of olfaction. Waveform of OEPs for various odorants were measured. The singualr value decomposition (SVD) method is applied to analyze the waveforms. The correlation of the response peak of OEPs at 300 milliseconds with the P300 response of the event related potential was discussed. B.G.

N86-27908# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
ELEMENTS OF RADIATION PROTECTION
M. Belli, S. Frullani, F. V. Orestano, and G. Campurra 15 Nov. 1985 101 p In ITALIAN; ENGLISH summary Seminar held in Rome, Italy, 21-23 Nov. 1983
(ISS-L-84/7; ISSN-0390-6493; ESA-86-97079) Avail: NTIS HC A06/MF A01

The biological effects of radiation, health effects of radiation, and the physical and medical aspects of radiation protection are discussed. For individual titles, see N86-27909 through N86-27912.

N86-27909# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
BIOLOGICAL EFFECTS OF IONIZING RADIATION [EFFETTI BIOLOGICI DELLE RADIAZIONI IONIZZANTI]
M. Belli *In its* Elements of Radiation Protection 15 Nov. 1985 28 p In ITALIAN (For primary document see N86-27908 18-52)
Avail: NTIS HC A06/MF A01

The processes leading to damage of living cells by ionizing radiation are reviewed. The discussion includes the definitions of relative biological effectiveness and linear energy transfer; a description of the primary processes and the effects on lipids, proteins and DNA; the DNA self-repairing processes; and theories of damaging mechanisms. It is concluded that DNA is the main target for permanent biological damage, which is a function of initial damage and recovery capacity. It is shown that mutation mechanisms where the effect-dose ratios do not show a threshold are relevant to genetic and cancerogenic effects. ESA

N86-27910# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
EFFECTS OF RADIATION HEALTH [EFFETTI SANITARI DELLE RADIAZIONI]
S. Frullani *In its* Elements of Radiation Protection 15 Nov. 1985 45 p In ITALIAN (For primary document see N86-27908 18-52)
Avail: NTIS HC A06/MF A01

The measurement of radiation parameters such as relative biological effectiveness and linear energy transfer, and the clinical effects of radiation as dependent of dose and type are reviewed in order to assess criteria for a radiation health policy. Stochastic and threshold effects are discussed. The protective regulations existing in the European Community are examined. It is shown that the dose limits are chosen to give a risk limit of one per thousand per year, that is ten times the amount corresponding to low risk professions. ESA

N86-27911# Calabria Univ., Cosenza (Italy).
OPERATING RADIATION PROTECTION: PHYSICAL ASPECTS [RADIOPROTEZIONE OPERATIVA: ASPETTI FISICI]
F. V. Orestano *In* Istituto Superiore di Sanita Elements of Radiation Protection 15 Nov. 1985 10 p In ITALIAN (For primary document see N86-27908 18-52)
Avail: NTIS HC A06/MF A01

The categories of radiation distinguished by Italian law and the function of the radiation expert required by Italian legislation to check working areas with a radiation hazard potential are examined. The details of the regulations are discussed and the full text of several norms is presented. ESA

N86-27912# European Nuclear Energy Agency, Frascati (Italy).
OPERATING RADIATION PROTECTION: MEDICAL ASPECTS [RADIOPROTEZIONE OPERATIVE: ASPETTI MEDICI]
G. Campurra *In* Istituto Superiore di Sanita Elements of Radiation Protection 15 Nov. 1985 12 p In ITALIAN (For primary document see N86-27908 18-52)
Avail: NTIS HC A06/MF A01

The duties of medical personnel working with radiation exposed workers are described. The nature of preliminary medical evaluations are explained, showing that the main goal is to determine workers' ability to support radiation risk and to identify as early as possible any pathological condition due to radiation or implying a physiological reduction of radiation resistance. Clinical examinations to be performed are classified and discussed. Italian regulations are included. ESA

N86-27913*# Arizona Water Resources Research Center, Tucson. Dept. of Physiology.
EFFECTS OF MUSCLE ATROPHY ON MOTOR CONTROL Final Technical Report, 1 Jun. 1982 - 31 May 1985
Douglas G. Stuart 1985 22 p
(Grant NAGw-338)
(NASA-CR-177201; NAS 1.26:177201) Avail: NTIS HC A02/MF A01 CSCL 06P

As a biological tissue, muscle adapts to the demands of usage. One traditional way of assessing the extent of this adaptation has been to examine the effects of an altered-activity protocol on the physiological properties of muscles. However, in order to accurately interpret the changes associated with an activity pattern, it is necessary to employ an appropriate control model. A substantial literature exists which reports altered-use effects by comparing experimental observations with those from animals raised in small laboratory cages. Some evidence suggests that small-cage-reared animals actually represent a model of reduced use. For example, laboratory animals subjected to limited physical activity have shown resistance to insulin-induced glucose uptake which can be altered by exercise training. This project concerned itself with the basic mechanisms underlying muscle atrophy. Specifically, the project addressed the issue of the appropriateness of rats raised in conventional-sized cages as experimental models to examine this phenomenon. The project hypothesis was that rats raised in small cages are inappropriate models for the study of muscle atrophy. The experimental protocol involved: 1) raising two populations of rats, one group in conventional (small)-sized cages and the other group in a much larger (133x) cage, from weanling age (21 days) through to young adulthood (125 days); 2) comparison of size- and force-related characteristics of selected test muscles in an acute terminal paradigm. Author

N86-27914# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCERNING BAROTRAUMA OF THE LUNGS-TRANSLATION
G. Khristov 5 Feb. 1986 20 p Transl. into ENGLISH from Khirurgiya (Bulgaria), v. 22, no. 6, 1969 p 589-597
(AD-A165006; FTD-ID(RS)T-1143-85) Avail: NTIS HC A02/MF A01 CSCL 06/5

The popularization and development of skin diving has led to the appearance of a new type of trauma of the lungs, caused by rapid change in air pressure in the lungs during sudden ascent of the diver with the breath held. Barotrauma of the lungs may be occasionally observed in anesthesiological practice as well. The paper discusses the etiopathogenesis, clinical manifestations and treatment of the complaint. The author has observed and described three cases of barotrauma of the lungs, one of which ended in death. It is emphasized that effective treatment of pulmonary barotrauma is feasible only when a barochamber is available, large enough to accommodate the performance of resuscitation and, if necessary, surgical interventions. GRA

N86-27915# School of Aerospace Medicine, Brooks AFB, Tex.
SOFT CONTACT LENS WEAR DURING +G(Z) ACCELERATION Final Report, Oct. 1982 - Jun. 1985
William J. Flynn, Michael G. Block, Wayne F. Provines, Thomas J. Tredici, and Robert D. Kullman Dec. 1985 23 p
(AD-A165013; USAFSAM-TR-85-84) Avail: NTIS

HC A02/MF A01 CSCL 17/8

The effects of +G sub z on soft contact lens wear are reported here. Human centrifuge rides up to +8G sub z were accomplished on 11 subjects. Six myopic subjects were tested with low-, medium-, and high-water-content spherical soft lenses. Two astigmatic subjects were tested with various designs of toric soft lenses. In addition, the contact lens subjects were tested with spectacles for comparison. Three emetropic subjects served as controls. Video photography was used to monitor lens position during the centrifuge rides; and visual acuity was checked at +1, +2, +4, +6 and +8 G sub z with a reduced Snellen eye chart. Each lens type and control run was evaluated in straight-ahead, lateral, and vertical gaze. No significant decentration was noted for any of the lens types tested up to the maximum level of +8 G sub z. Visual acuity was reduced at the higher +G sub z levels for contact lenses, and spectacle trials, and with the emmetropic controls--all to similar levels. Contact lens did not produce any corneal insult due to the +G sub z exposure. Author (GRA)

N86-27916# Army Research Inst. of Environmental Medicine, Natick, Mass.

INFLUENCE OF ERYTHROCYTHEMIA ON BLOOD VOLUME AND THERMOREGULATION DURING EXERCISE-HEAT STRESS

Michael N. Sawka, Richard C. Dennis, Richard R. Gonzalez, Andrew J. Young, and Stephen R. Muza 1986 31 p

(AD-A165014; USARIEM-M-13/86) Avail: NTIS HC A03/MF A01 CSCL 06/19

We studied the effects of autologous erythrocyte infusion on blood volume and thermoregulation during exercise in the heat. Using a double blind design, nine unacclimated male subjects were infused with either 700 ml of a NaCl glucose-phosphate solution containing approx. 60% hematocrit (n=6, reinfusion) or 700 ml of this solution only (n=3, saline). A heat stress test (HST) was attempted approximately 2 wk pre-and 48 h post-infusion during the late spring months. After 30 min of rest in a 20 C antechamber, the HST consisted of a 120-min exposure (two repeats of 15-min rest and 45-min treadmill walking) in a hot (35c, 45% rh) environment while euhydrated. Red cell volume (RCV, 51 CR) and plasma volume (PV, 125I) were measured 24-h before each HST, and maximal oxygen uptake (VO2 max) was measured 24-h after each HST. Generally, no significant effects were found for the saline group. For the reinfusion group, RCV (11%, $P<0.01$) and V02 max (11%, $P<0.05$) increased after infusion, and the following observations were made: (1) the increased RCV was associated with a reduction in PV to maintain the same blood volume as during the preinfusion measurements; (2) erythrocythemia reduced total circulating protein, but did not alter F-cell ratio, plasma osmolality, plasma protein content, or plasma lactate at rest or during exercise-heat stress; (3) erythrocythemia did not change the volume of fluid entering the intravascular space from rest to exercise-heat stress. GRA

N86-27917# Army Research Inst. of Environmental Medicine, Natick, Mass.

URINARY AND HEMATOLOGICAL INDICES OF HYPOHYDRATION

R. P. Francesconi, R. W. Hubbard, P. C. Szlyk, D. Schnakenberg, and D. Carlson 1986 22 p

(AD-A165015; USARIEM-M-15/86) Avail: NTIS HC A02/MF A01 CSCL 06/19

As part of a large scale field feeding system test we had the unique opportunity to collect and study hundreds of overnight urine aliquots which were obtained immediately prior to a fasting blood sample on days 1, 20, and 44 of the field test. To evaluate the hydrational status of test subjects and criteria of hypohydration, urine aliquots were categorized by specific gravity > or = 1.03 (n=124) or < 1.03 (n=540). Creatinine levels were elevated ($p<.001$) in the concentrated urine samples, but a decreased trend in Na(+)/K(+) ratios in these samples failed to achieve statistical significance ($p=0.1$). However, when individuals with high specific gravity urine were further subclassified by a criterion of weight loss > 3% from original body weight, then creatinine concentrations were elevated ($p=.05$) while Na(+)/K(+) ratios were decreased ($p=.05$) when compared with levels in subjects also with high specific gravity but weight loss < 3%. Serum urea nitrogen/creatinine ratios were significantly increased (days 1 and 44, $p=.02$) in test subjects whose urine samples exceeded 1.03 in specific gravity. The results of this study indicated that prodromal hypohydration, indicated by concomitant elevations in urinary specific gravity and creatinine, was not reflected in the common indices of circulatory hypohydration- hematocrit and osmolality. Alternatively, urea nitrogen/creatinine ratio may be a sensitive circulatory index of imminent hypohydration. GRA

N86-27918# Health Effects Research Lab., Research Triangle Park, N. C.

FACTORS INFLUENCING CARBOXYHEMOGLOBIN STABILITY Final Report, 1983 - 1984

George M. Goldstein, Louis Raggio, and Dennis House 26 Mar. 1985 39 p Prepared in cooperation with Rockwell International Corp., Chapel Hill, N.C.

(AD-A165032; TR-1811) Avail: NTIS HC A03/MF A01 CSCL 06/1

Carbon monoxide (CO) is a byproduct of the incomplete combustion of hydrocarbons. Because of its high affinity for oxygen binding sites on hemoglobin and displacing oxygen, the presence of CO in the atmosphere has been shown to produce adverse health effects, affecting the cardiovascular system as well as causing behavioral changes. These changes have been reported at concentrations of carboxyhemoglobin (COHB) in the range of 4 to 6%. The Department of Defense (DOD) is concerned about the production of CO in fixed and mobile weapon systems and the relationship between behavior and health effects in military personnel associated with this exposure. The source of CO in a combat situation is exhaust gases from motorized vehicles and propellant gases from weapon systems. Studies were conducted to determine the stability of carboxyhemoglobin (COHb) in evacuated blood containers using the IL-282 co-oximeter as the measurement instrument. This study has shown that COHb levels decrease by 5 to 10% of the original value after three days of storage and remain stable for 14 days at 4 C or 21 C in vacutainers containing heparin or EDTA. The storage temperature, 4 C or 21 C had no appreciable affect on COHb levels. Blood samples that contained the anticoagulant heparin had higher initia l values of COHb than samples with EDTA. In this study ambient room light levels did not affect the measured levels of COHb at 4C for 5 days. GRA

N86-27919# Texas Univ., Arlington. Dept. of Psychology.

EFFECTS OF ATROPINE SULFATE ON AIRCREW PERFORMANCE Final Report, Mar. 1983 - Apr. 1985

Michael L. Lobb, James D. Phillips, Jr., and A. S. Winter Dec. 1985 16 p

(Contract F33615-83-K-0611)

(AD-A165063; USAFSAM-TR-85-48) Avail: NTIS HC A02/MF A01 CSCL 06/15

The human/animal literature on performance effects of atropine sulfate is reviewed and extrapolated to aircrew requirements. Subjective reports and physiological dose-response curves are used to estimate effective dosage levels for performance; ED50 is the dose at which 50% of an aircrew experiences a detectable performance change. Based on this review and extrapolation, the ED40 level for atropine sulfate is 2 mg IM/person for performance effects on near vision, alertness, equilibrium, response-force discrimination, and enunciation: the ED5 level is estimated at 1.35 mg IM/person. Although the published literature on simultaneously administered acetylcholinesterase inhibitors and blockers is insufficient to warrant even a tentative conclusion, the initial results suggest a combined mode of action in the visual system; if confirmed, such action would limit the use of atropine to counteract chemical-warfare performance decrements. Thus although atropine may be lifesaving, it does not prevent aircrew performance losses due to chemical-warfare agents and may impose additional decrements. GRA

N86-27870# Joint Publications Research Service, Arlington, Va.
LACTOBACTERIA AND PROPHYLAXIS IN SPACE
I. Ivanov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 1 Transl. into ENGLISH from Tass (Tartu, USSR), 11 Mar. 1986 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

N86-27872# Joint Publications Research Service, Arlington, Va.
SWEATING REFLEX IN COMPLEX OF METHODS FOR EVALUATING OPERATOR EFFICIENCY
P. P. Slynko, L. I. Bukvareva, S. V. Zaporozhets, and P. M. Onishchenko *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 46 Transl. into ENGLISH from Fiziologicheskiy Zhurnal (Kiev, USSR), v. 31, no. 6, Nov. - Dec. 1985 p 678-682 Original language document was announced as A86-21453 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

N86-27874# Joint Publications Research Service, Arlington, Va.
EFFECTS OF COLD EXPOSURE ON THERMAL STATUS OF MEN AND WOMEN
R. F. Afanasyeva and R. O. Oganyan *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 100 Transl. into ENGLISH from Gigiyena Truda i Professionalnyye Zabolevaniya (Moscow, USSR), no. 1, Jan. 1986 p 24-28 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

N86-27875# Joint Publications Research Service, Arlington, Va.
STUDY OF BRAIN BIOCHEMISTRY DURING HYPOTHERMIA
E. E. Emirbekov and S. P. Lvova *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 101 Transl. into ENGLISH from Kriobiologiya (Kiev, USSR), no. 1, 1985 p 44-49 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

N86-27876# Joint Publications Research Service, Arlington, Va.
SOMATOSENSORY AND AUDITORY PERCEPTION ACCORDING TO STUDY USING FOCUSED ULTRASOUND
Ye. M. Tsirulnikov *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-008) 9 May 1986 p 102 Transl. into ENGLISH from Zhurnal Evolyutsionnoy Biokhimii i Fiziologii (Leningrad, USSR), v. 21, no. 6, Nov. - Dec. 1985 p 591-596 (For primary document see N86-27869 18-51)
Avail: NTIS HC A07/MF A01

N86-27879# Joint Publications Research Service, Arlington, Va.
PROSPECTS FOR USING ULTRAVIOLET RADIATION IN LONG-TERM SPACEFLIGHTS
N. Ye. Panferova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 1-13 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 4-12 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27880# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL AND GENERAL THEORETICAL RESEARCH: NATURE OF CIRCULATORY REGULATION IN PILOTS
V. G. Doroshev, Z. A. Kirillova, and A. P. Vanarshenko *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 14-18 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 12-15 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27882# Joint Publications Research Service, Arlington, Va.
EFFECT OF INTENSIVE OPERATOR WORK ON LIPID PEROXIDATION PROCESSES IN MAN
S. M. Ivanova, O. N. Orlov, S. S. Brantova, O. I. Labetskaya, N. A. Davydova, A. Ye. Zezerov, and A. S. Ushakov *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 25-28 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 20-22 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27884# Joint Publications Research Service, Arlington, Va.
DISTINCTIONS IN HUMORAL CONTROL OF METABOLISM WITH SIMULATION OF SPACEFLIGHT FACTORS
S. Kalandarov, V. P. Bychkov, I. D. Frenkel, and G. I. Proskurova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 34-38 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 25-28 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27885# Joint Publications Research Service, Arlington, Va.
SOME HUMAN REACTIONS DURING 7-DAY ANTIORTHOSTATIC HYPOKINESIA
B. F. Asyamolov, V. S. Panchenko, V. A. Karpusheva, R. A. Bondarenko, O. A. Vorobyev, V. V. Zaritskiy, V. P. Stupnitskiy, I. G. Popov, P. A. Lozinskiy, and S. M. Ledovskoy *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 39-44 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 29-32 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27887# Joint Publications Research Service, Arlington, Va.
HUMAN CENTRAL HEMODYNAMICS DURING LOWER LIMB DECOMPRESSION
V. V. Rumyantsev and V. Ye. Katkov *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 49-52 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 35-37 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27888# Joint Publications Research Service, Arlington, Va.
PHASIC PROCESSES IN KINETICS OF FORMED BLOOD ELEMENTS
V. V. Verigo and F. Gauser *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 53-58 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 38-41 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27892# Joint Publications Research Service, Arlington, Va.
T AND B COMPONENTS OF IMMUNITY IN THE PRESENCE OF ACUTE MOUNTAIN SICKNESS
M. M. Mirrakhimov, M. I. Kitayev, R. O. Khamzamulin, A. G. Tokhtabayev, and S. M. Pogrebitskiy *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 79-84 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 53-56 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27893# Joint Publications Research Service, Arlington, Va.
EFFECT OF DIFFERENT DOSES OF ULTRAVIOLET RADIATION ON VITAMIN LEVELS IN MAN
M. S. Belakovskiy, M. G. Yuzhanskaya, N. Ye. Panferova, L. Kh. Pastushkova, O. G. Pereverzeva, A. N. Smirnova, I. N. Sergeyev, and V. B. Spirichev *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 85-91 Transl. into ENGLISH from

Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 56-61 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27895# Joint Publications Research Service, Arlington, Va.
RADIOBIOLOGICAL VALIDATION OF QUALITY FACTOR OF PROTONS AND HELIUM IONS
N. I. Ryzhov and B. S. Fedorenko *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 95-99 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, Jan. - Feb. 1986 p 63-66 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27899# Joint Publications Research Service, Arlington, Va.
METHOD OF DEMONSTRATING CALCIUM IN HUMAN FOOT BY NEUTRON ACTIVATION OF (ALPHA, N)-SOURCES
V. Ye. Zaychik, A. Ye. Kondrashov, and B. V. Morukov *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 113-119 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, Jan. - Feb. 1986 p 75-78 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27901# Joint Publications Research Service, Arlington, Va.
AMINO ACID SPECTRUM OF HUMAN BLOOD IN THE PRESENCE OF EMOTIONAL STRESS
T. F. Vlasova, A. S. Ushakov, V. P. Bychkov, and Ye. B. Miroshnikova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 123-125 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 80-82 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27902# Joint Publications Research Service, Arlington, Va.
BLOOD SERUM ENZYMES DURING 7-DAY WATER IMMERSION
T. Ye. Drozdova and Ye. G. Vetrova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 126-128 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 82-83 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27904# Joint Publications Research Service, Arlington, Va.
RADIOPROTECTIVE AND THERAPEUTIC EFFICACY OF CARRAGEENAN AGAINST PROTON RADIATION
K. S. Chertkov, N. I. Gvozdeva, B. S. Fedorenko, and Yu. Yu. Preobrazhenskiy *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 132-135 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 84-86 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N86-27920*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYTICAL TECHNIQUES OF PILOT SCANNING BEHAVIOR AND THEIR APPLICATION
Randall L. Harris, Sr., Bobby J. Glover (PRC Kentron, Inc., Hampton, Va.), and Amos A. Spady, Jr. Jul. 1986 46 p refs
(NASA-TP-2525; L-15995; NAS 1.60:2525) Avail: NTIS HC A03/MF A01 CSCL 05I

The state of the art of oculometric data analysis techniques and their applications in certain research areas such as pilot workload, information transfer provided by various display formats, crew role in automated systems, and pilot training are documented. These analytical techniques produce the following data: real-time viewing of the pilot's scanning behavior, average dwell times, dwell percentages, instrument transition paths, dwell histograms, and entropy rate measures. These types of data are discussed, and overviews of the experimental setup, data analysis techniques, and software are presented. A glossary of terms frequently used in pilot scanning behavior and a bibliography of reports on related research sponsored by NASA Langley Research Center are also presented. Author

N86-27921# School of Aerospace Medicine, Brooks AFB, Tex.
US AIR FORCE COMBAT PSYCHIATRY Final Report, Jan. 1979 - Jun. 1985
David R. Jones Jan. 1986 44 p
(AD-A165011; USAFSAM-TR-85-83) Avail: NTIS HC A03/MF A01 CSCL 05/10

The U.S. Air Force faces the distinct possibility that its bases may be vulnerable to enemy attack. Combat fatigue may thus affect nonfliers, whereas in past conflicts fliers have been the ones affected. This report reviews the literature on the effects of combat: first on fliers, then on nonfliers. The report suggests that flight surgeons use 2 main agents of therapy, rest and the force of their personality, to delay or prevent combat fatigue in fliers. The report also discusses the relevant signs and symptoms, both in fliers and in nonfliers, and ends with a presentation of the principles of Brevity, Immediacy, Centrality, Expectancy, Proximity, and Similicity in dealing with combat fatigue in nonfliers. GRA

N86-27922# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Psychology.
INITIAL SKILL LEARNING: AN ANALYSIS OF HOW ELABORATIONS FACILITATE THE THREE COMPONENTS Technical Report, Oct. 1984 - Feb. 1986
Davida H. Charney and Lynne M. Reder 14 Feb. 1986 57 p
(Contract N00014-84-K-0063)
(AD-A165137; TR-86-1-ONR) Avail: NTIS HC A04/MF A01 CSCL 05/10

This paper is concerned with the issue of how verbal instructions influence skill learning. In particular, our goal is to outline the components of initial cognitive skill acquisition and analyze what features of elaborations in the instructional materials can facilitate each component. We identify three basic components of skill learning: learning novel concepts and the functionality of novel concepts and procedures; learning how to execute the procedures; and learning the conditions under which the procedures can and should be applied. Each of these components can be learned independently and each component can be a bottleneck to acquiring a skill. Situation examples are the most useful type of elaboration for skill learning because each example can contribute to learning in all three components. On the other hand, while analogies can be constructed to illustrate each component, they are more likely to help people learn the functionality of a procedure than how to execute it or when to select it. However, since learners tend to rely on examples as models, it is very important to choose examples with great care and to provide enough examples to illustrate the range of application of a rule or procedure. Otherwise, learners may interpret a rule incorrectly or make spurious assumptions about the conditions under which it applies. GRA

N86-27881# Joint Publications Research Service, Arlington, Va.
PSYCHOEMOTIONAL PILOT STRESS PRIOR TO EJECTION AND ITS ROLE IN APPROPRIATE PERFORMANCE
A. P. Kozlovskiy and A. F. Kovalenko *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 19-24 Transl. into ENGLISH

from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 16-19 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

N86-27883# Joint Publications Research Service, Arlington, Va.
EFFECT OF RHYTHMIC PHOTIC INTERFERENCE ON WORKING ELECTROENCEPHALOGRAM AND EFFICIENCY OF HUMAN MOVEMENTS
Ye. T. Petrenko and L. A. Yermukhametova *In its* USSR Report: Space Biology and Aerospace Medicine, No. 1, January - February 1986 (JPRS-USB-86-003) 17 Apr. 1986 p 29-33 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 20, no. 1, Jan. Feb. 1986 p 22-25 (For primary document see N86-27878 18-51)
Avail: NTIS HC A08

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

No abstracts in this category.

55 PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

N86-27923# Southwest Research Inst., San Antonio, Tex. Dept. of Bioengineering.
EFFECTS OF 60 Hz ELECTRIC FIELDS ON OPERANT AND SOCIAL STRESS BEHAVIORS OF NONHUMAN PRIMATES
W. R. Rogers, J. H. Lucas, G. T. Moore, and J. L. Orr 1985 18 p Presented at the DOE Contractors Conference, Alexandria, Va., 5 Nov. 1985
(Contract DE-AC02-80RA-50219)
(DE86-003748; CONF-8511143-1) Avail: NTIS HC A02/MF A01

An overall description of this research program is presented. The objectives are to investigate the use of nonhuman primates to investigate possible behavioral effects associated with exposure to high-intensity, 60 Hz, electric fields. DOE

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N86-27924# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
ENGINEERING SCIENCE AND MECHANICS COMPUTER LABORATORY USER'S GUIDE
C. Thompson and C. Hawley Feb. 1986 13 p
(PB86-166022; VPI-E-86-4) Avail: NTIS HC A02/MF A01 CSCL 09B

The User's Guide introduces the services and resources provided by the Engineering Science and Mechanics Computer Laboratory. Topics include general information regarding the hours of operation, accounting procedures, and methods of communicating with other computers on campus. GRA

N86-27498# Joint Publications Research Service, Arlington, Va.
ENGINEERING STANDARD OF MOS MEMORY MODULE
Jingdong Chen, Zucai Zhu, and Zhongquan Xu *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 174-179 Transl. into ENGLISH from Jisuanji Yanjiu Yu Fazhan (Beijing, China), v. 21, no. 11, Nov. 1984 p 30-36 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N86-27925*# National Aeronautics and Space Administration, Washington, D.C.
COMPUTER-ASSISTED DESIGN OF ORGANIC SYNTHESIS
Hiroshi Kaminaka Apr. 1986 20 p Transl. into ENGLISH from Kagaku to Kogyo (Osaka, Japan), v. 59, no. 7, 1985 p 263-268 Transl. by SCITRAN, Inc., Santa Barbara, Calif.
(Contract NASw-4004)
(NASA-TM-88401; NAS 1.15:88401) Avail: NTIS HC A02/MF A01 CSCL 09B

The computer programs to design synthetic pathways of organic compounds have been utilized throughout the world since the first system was reported by Corey in 1969, and the LHASA was reported in1972 to become the predominant system. Many programs have been reported mainly in the United States and Europe, and groups of corporations, especially chemical companies, have been trying to improve programs and increase the efficiency of research. In Japan, unfortunately, no concrete movement in this area has been seen. Of course, it goes without saying that these kinds of programs are effective for efficient research, but the remarkable aspect is that these can present unexpected data to the researchers to stimulate them to develop new ideas. Author

N86-27926# Lockheed-California Co., Burbank.
KRASH85 USER'S GUIDE: INPUT/OUTPUT FORMAT Final Report, Jan. 1984 - Sep. 1984
M. A. Gamon, G. Wittlin, and W. L. LaBarge Jul. 1985 235 p
(DOT/FAA/CT-85/10-Rev; LR-30777-Rev) Avail: NTIS HC A11/MF A01 CSCL 09B

Program KRASH as modified under Contract DTFA03-84-C-00004 is described. The updated version is denoted KRASH85. This document is a User's Guide and defines the input and output formats appropriate for KRASH85. Features that are incorporated into KRASH85 include: an improved plastic hinge moment algorithm; gear-oleo metering pin coding; load-interaction curves; an expanded initial conditions subroutine (combined with NASTRAN); a comprehensive energy balance; center of gravity (c.g.) displacement, velocity, acceleration and force time histories; revised vertical beam orientation coding; provision to save data for post-processing i.e., acceleration, mass location and forces; provisions to input preprocessed data; a corrected uncoupled KR curve unloading/reloading algorithm; provisions to define a tire spring (remains normal to ground plane); provisions to number the masses to an arbitrary sequence; and an option to compute section shear and moment distributions. Author

N86-27927*# Operations Research, Inc., Rockville, Md.
SPECTRUM ORBIT UTILIZATION PROGRAM DOCUMENTA-

TION: SOUP5 VERSION 3.8 USER'S MANUAL, VOLUME 1, CHAPTERS 1 THROUGH 5 Final Report
J. Davidson, H. R. Ottey, P. Sawitz, and F. S. Zusman 10 Jun. 1985 194 p
(Contract NAS3-22885)
(NASA-CR-174889; NAS 1.26:174889; TR-2273-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 09B

The underlying engineering and mathematical models as well as the computational methods used by the Spectrum Orbit Utilization Program 5 (SOUP5) analysis programs are described. Included are the algorithms used to calculate the technical parameters, and references to the technical literature. The organization, capabilities, processing sequences, and processing and data options of the SOUP5 system are described. The details of the geometric calculations are given. Also discussed are the various antenna gain algorithms; rain attenuation and depolarization calculations; calculations of transmitter power and received power flux density; channelization options, interference categories, and protection ratio calculation; generation of aggregate interference and margins; equivalent gain calculations; and how to enter a protection ratio template. B.G.

N86-27928*# Operations Research, Inc., Rockville, Md.
SPECTRUM ORBIT UTILIZATION PROGRAM DOCUMENTATION: SOUP5 VERSION 3.8 USER'S MANUAL, VOLUME 2, APPENDICES A THROUGH G Final Report
J. Davidson, H. R. Ottey, P. Sawitz, and F. S. Zusman 10 Jun. 1985 124 p
(Contract NAS3-22885)
(NASA-CR-174890; NAS 1.26:174890; TR-2273-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 09B

The appendixes of the user manual are presented. Input forms which may be used to prepare data for the SOUP5V3.4 of the R2BCSAT-83 data base are given. The IBM job control language which can be used to run the SOUP5 system from a magnetic tape is described. Copies of a run using the delivered tape and IBM OS/MVS Job Control Language card deck are illustrated. Numerical limits on scenario data requests are listed. Error handling, error messages and editing procedures are also listed. Instructions as to how to enter a protection ratio template are given. And relation between PARC prameter, channelization, channel families, and interference categories are also listed. E.R.

N86-27929# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
FLIGHT SIMULATION MOTION-BASE DRIVE ALGORITHMS. PART 2: SELECTING THE SYSTEM PARAMETERS
L. D. Reid and M. A. Nahon May 1986 231 p Sponsored by tyhe Canadian Transportation Development Centre
(UTIAS-307; ISSN-0082-5255) Avail: NTIS HC A11/MF A01

A project aimed at developing and testing flight simulator motion-base drive algorithms suited for commercial jet transports is discussed. Full six degrees-of-freedom motion of a synergistic motion-base is being studied. Three forms for these algorithms are being considered: (1) classical linear washout, (2) optimal control, and (3) coordinated adaptive washout. It is felt that the latter two techniques may provide some advantages over the classical, which is currently employed in most commercial flight simulators. A filter parameter selection process using typical jet transport maneuvers as input signals is discussed. The filter parameters were adjusted to produce a range of washout characteristics. The pilot's motion sensations produced by these tests were estimated through the use of linear models of the human vestibular system. Nine sets of washout filters were generated for future evaluation by a group of pilots. Computer listings of the real-time software are presented along with numerous test results. Author

N86-27930*# College of William and Mary, Williamsburg, Va. Dept. of Computer Science.
A HIGH-ORDER LANGUAGE DOR A SYSTEM OF CLOSELY COUPLED PROCESSING ELEMENTS Final Report
Stefan Feyock and W. Robert Collins Jul. 1986 67 p
(Grant NAG3-232)
(NASA-CR-177280; NAS 1.26:177280) Avail: NTIS HC A04/MF A01 CSCL 09B

The research reported in this paper was occasioned by the requirements on part of the Real-Time Digital Simulator (RTDS) project under way at NASA Lewis Research Center. The RTDS simulation scheme employs a network of CPUs running lock-step cycles in the parallel computations of jet airplane simulations. Their need for a high order language (HOL) that would allow non-experts to write simulation applications and that could be implemented on a possibly varying network can best be fulfilled by using the programming language Ada. We describe how the simulation problems can be modeled in Ada, how to map a single, multi-processing Ada program into code for individual processors, regardless of network reconfiguration, and why some Ada language features are particulary well-suited to network simulations. Author

N86-27931*# Research and Data Systems, Inc., Lanham, Md.
NIMBUS-7 ERB DELMAT OPERATORS GUIDE AND MAINTENANCE MANUAL
Lanning M. Penn and Philip E. Ardanuy Mar. 1986 67 p
(Contract NAS5-27728)
(NASA-CR-17874; NAS 1.26:17874; RDS-TR-82-08-04) Avail: NTIS HC A04/MF A01 CSCL 09B

Described in detail are the ERB DELMAT algorithms used to correct the wide field-of-view channels (11, 12, 13 and 14) radiometer data. The computer software and the required operational environment are also delineated. The information and procedures required to maintain the DELMAT program are also described. Author

N86-27932*# Houston Univ., Tex. Dept. of Computer Science.
DATABASE INTERFACES ON NASA'S HETEROGENEOUS DISTRIBUTED DATABASE SYSTEM Semiannual Report
Shou-Hsuan Stephen Huang 14 Jul. 1986 34 p
(Grant NAG5-739)
(NASA-CR-177248; NAS 1.26:177248) Avail: NTIS HC A03/MF A01 CSCL 09B

The purpose of the ORACLE interface is to enable the DAVID program to submit queries and transactions to databases running under the ORACLE DBMS. The interface package is made up of several modules. The progress of these modules is described below. The two approaches used in implementing the interface are also discussed. Detailed discussion of the design of the templates is shown and concluding remarks are presented. Author

N86-27933*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
A GENERAL NUMERICAL ANALYSIS PROGRAM FOR THE SUPERCONDUCTING QUASIPARTICLE MIXER
Ross G. Hicks, Marc J. Feldman, and Anthony R. Kerr Jul. 1986 117 p
(NASA-TM-86145; NAS 1.15:86145) Avail: NTIS HC A05/MF A01 CSCL 09B

A user-oriented computer program SISCAP (SIS Computer Analysis Program) for analyzing SIS mixers is described. The program allows arbitrary impedance terminations to be specified at all LO harmonics and sideband frequencies. It is therefore able to treat a much more general class of SIS mixers than the widely used three-frequency analysis, for which the harmonics are assumed to be short-circuited. An additional program, GETCHI, provides the necessary input data to program SISCAP. The SISCAP program performs a nonlinear analysis to determine the SIS junction voltage waveform produced by the local oscillator. The quantum theory of mixing is used in its most general form, treating the large signal properties of the mixer in the time domain. A small signal linear analysis is then used to find the conversion loss and port impedances. The noise analysis includes thermal noise from the termination resistances and shot noise from the periodic LO current. Quantum noise is not considered. Many aspects of the program have been adequately verified and found accurate. Author

N86-27934# Naval Research Lab., Washington, D. C.
EXECUTING TRACE SPECIFICATIONS USING PROLOG Interim Report, Jan. 1984 - Jun. 1985
John D. McLean, David M. Weiss, and Carl E. Landwehr 21 Jan. 1986 13 p
(AD-A164877; NRL-8940) Avail: NTIS HC A02/MF A01 CSCL 09/2

Trace specifications have some desirable properties that most specifications lack: they are abstract, so they need not impose unnecessary constraints on the implementor; and they are formal, so they can be understood unambiguously and can be rigorously tested for consistency, totalness, and correctness of implementation. Nevertheless, understanding trace specifications and translating them to computer programs are significant tasks. This report documents experiments in translating trace specifications to Prolog so that they can be executed directly. The selection of Prolog over other possible languages is discussed, and several example specifications and their translations are presented. Some generally useful Prolog predicates are gleaned from these examples, and difficulties encountered in performing the translations are described. On the way, an implementation-free semantics for a subset of Prolog is given. The report concludes with a discussion of possibilities for mechanically translating trace specifications to Prolog. Author (GRA)

N86-27935# Naval Postgraduate School, Monterey, Calif.
OZDRAW: A REAL-TIME INTERACTIVE FIGURE GENERATION SYSTEM M.S. Thesis
Steven J. Firth Dec. 1985 60 p
(AD-A165020) Avail: NTIS HC A04/MF A01 CSCL 09/2

The capability to produce and reproduce quality technical figures, such as those found in official reports and academic papers is invaluable in a business, administrative or academic environment. Ideally, the user should have the ability to produce a figure quickly and with a minimum of effort. Further, if the user is using an automated or semi-automated process he should not be encumbered by the requirement to learn, and hence remember, complex operating procedures; the system should be simple, self-documenting, powerful and yet be able to be used by an untrained person. Numerous automated systems have been devised to aid the author in the figure generation process. Few of these systems have used visual feedback during figure production. These non-visual systems tend to be based upon operating system-like command interfaces. The main reason for this limitation was the prohibitive expense of computer-graphics terminals and workstations with sufficient capabilities to provide real-time, interactive feedback. With the advances in display technology has come a significant drop in price such that this has become less of a problem. Consequently, this thesis re-opens the issue of computer-assisted technical figure generation. It does this in terms of a real-time, interactive figure gen eration. Author (GRA)

N86-27936# Army Electronic Proving Ground, Fort Huachuca, Ariz.
METHODOLOGY INVESTIGATION, PROGRAM FLOW ANALYZER, VOLUME 2 Final Report
Edward L. Anderson Sep. 1985 108 p
(AD-A165029) Avail: NTIS HC A06/MF A01 CSCL 09/2

The table-driven Assembly Code Analysis Program (ACAP) is one component in a family of automated software assessment tools. These tools extract information about software quality features of the target software being examined. ACAP provides a translator which can be modified to tailor it to the specific assembly language of the target software. Provision is also made in the ACAP system for generating reports from information collected by other language translators. The ACAP system has been developed on the Digital Equipment VAX series of computers utilizing VMS. The ACAP is written entirely in VAX/DCL and FORTRAN. The table driven ACAP system accepts input defining the mnemonics of the assembler language to be analyzed. Depending on the particular language, the statement parser may need modification and subsequent linkage within the code translation section of ACAP. ACAP determines information about the structure, complexity, use of instructions and variables, and selected quality parameters. A general purpose report writer interfaces with ACAP and other code analysis programs. Data generated by these programs are provided via files to the Report Writer. These files supply the data that creates the software assessment reports, and in addition, are concatenated into a single maste r file. The ACAP system also provides the capability to create a paginated, sequenced listing to assist in software assessment activities. GRA

N86-27937# Softech, Inc., Waltham, Mass.
Ada (TRADEMARK) TRAINING CURRICULUM: ADVANCED Ada TOPICS L305 TEACHER'S GUIDE, VOLUME 1
1986 389 p
(Contract DAAB07-83-C-K506)
(AD-A165075) Avail: NTIS HC A17/MF A01 CSCL 09/2

This teacher's guide on advanced Ada topics consists of the following sections: (1) Basic structuring features; (2) Recursive subprograms; (3) Sets using Boolean arrays; (4) Linear lists; (5) Linked lists and recursive types; (6) Data type encapsulation; (7) Private types; (8) Limited private types; and (9) use of exceptions. GRA

N86-27938# Softech, Inc., Waltham, Mass.
Ada (TRADEMARK) TRAINING CURRICULUM: ADVANCED Ada L305 TEACHER'S GUIDE, VOLUME 2
1986 616 p
(Contract DAAB07-83-C-K506)
(AD-A165076) Avail: NTIS HC A99/MF A01 CSCL 09/2

This teachers' guide on advanced Ada topics consist of the following sections: (10) Overloading; (11) Generic units; (12) Derived types; (13) Unchecked deallocation; (14) Generic packages for stacks; (15) Trees; (16) Searching; (17) Sorting; (18) Linked list implementation of sets; (19) Mergeable sets; and (20) Graphs. GRA

N86-27939# Softech, Inc., Waltham, Mass.
Ada (TRADEMARK) TRAINING CURRICULUM: ADVANCED Ada TOPICS L305 TEACHER'S GUIDE, VOLUME 3
1986 184 p
(Contract DAAB07-83-C-K506)
(AD-A165077) Avail: NTIS HC A09/MF A01 CSCL 09/2

This teachers' guide on advanced Ada topics consist of the following sections: (21) Low level and implementation - dependent features; (22) Example of low level programming; and, (23) Overview of Ada task language. GRA

N86-27940# Softech, Inc., Waltham, Mass.
Ada (TRADEMARK) TRAINING CURRICULUM: INTRODUCTION TO SOFTWARE ENGINEERING M102 TEACHER'S GUIDE
1986 548 p
(Contract DAAB07-83-C-K506)
(AD-A165122) Avail: NTIS HC A23/MF A01 CSCL 05/9

The Ada training curriculum: Introduction to software engineering M102 teacher's guide contains the following program: Day 1 - (1) Introduction - Background and Motivation; (2) Software Engineering and its Goals - Goals, and Software Engineering Principles; (3) How These Goals are Achieved - The Life-Cycle Model to Develop Systems, MIL-STDS and Documentation, Introduction to Methods and Tools, Requirements Analysis: Introduction, and Analysis Method Overview; Day 2 - (4) How These Goals are Achieved (Continued) - Design Overview, Design Method Overview, Detailed Design Techniques, Implementation Overview, Structured Programming, Testing Approaches, and Software Management; Summary-Relationship of Software Engineering Techniques to Ada. GRA

N86-27941# Softech, Inc., Waltham, Mass.
Ada (TRADEMARK) TRAINING CURRICULUM: SOFTWARE ENGINEERING FOR MANAGERS M101 TEACHER'S GUIDE
1986 359 p
(Contract DAAB07-83-C-K506)
(AD-A165123) Avail: NTIS HC A16/MF A01 CSCL 05/9

The Ada training curriculum: Software engineering for managers M101 teacher's guide contains the following: (1) Background and Motivation - Definition of Software Engineering, and Motivation for Software Engineering (Software Crisis); (2) Software Engineering and its Goals - Software Engineering Goals, and Software Engineering Principles; (3) Achieving Software Engineering Goals - Software Life-Cycle, Methods and Tools for each phase of Life-Cycle, Testing, and Software Management: (4) Software Engineering and Ada - Relationship of Software Engineering to Ada. GRA

N86-27942# Army Electronic Proving Ground, Fort Huachuca, Ariz.
PROGRAM FLOW ANALYZER. VOLUME 1 Final Methodology Investigation Report
Edward L. Anderson Sep. 1985 31 p
(AD-A165152) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Program Flow Analyzer (PFA) methodology investigation developed an automated tool for software analysis in such a manner as to simplify the effort required to develop new front-end encoders. While the PFA design has allowed a significant reduction in development time for new front-end encoders,there is a need for a more flexible multi-lingual capability. It is recommended that the Multi-lingual Static Analysis Tool be developed to satisfy this need. GRA

N86-27943# Oklahoma State Univ., Stillwater. Electronics Lab.
IRIG FORMAT B DECODER
John Pearson and Jerry Grayson Jun. 1985 21 p
(Contract F19628-81-C-0079)
(AD-A165225; AFGL-TR-85-0193; SR-4) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes a special application of a microprocessor for decoding a serial bit stream of data from an IRIG B time code generator. The report covers theory of operation, suggestions for improvement and modification and a listing of the system software. GRA

N86-27944# Naval Postgraduate School, Monterey, Calif.
THE DESIGN AND ANALYSIS OF A COMPLETE ENTITY-RELATIONSHIP INTERFACE FOR THE MULTI-BACKEND DATABASE SYSTEM M.S. Thesis
Philip L. Goisman 19 Dec. 1985 93 p
(AD-A165255) Avail: NTIS HC A05/MF A01 CSCL 09/2

Interest in increasing programmer productivity has spawned new software tools. Some of these tools are statistical packages, program generators, and database management systems (DBMS). One area of DBMS research designed to improve the efficiency of DBMS is the multi-lingual database system (MLDS). MLDS combines software and hardware technology to gain efficiency and versatility in DBMS. The MLDS design goals overcome the conventional limitation to develope a database system that supports a single data model and a corresponding model-based data languages are SQL, DL/I, CODASYL, and Daplex. These models and their data languages are supported conventionally by separate DBMS. Instead, MLDS as a single DBMS is capable of supporting multiple models and their respective database languages. This thesis presents a methodology for supporting entity-relationship database management on an attribute-based database system, since the heart of MLDS is the attribute-base system. Specifically, it provides the design specifications for transforming Daplex requests into equivalent attribute-based data language requests. During this design process, we describe the data structures, control structures, and the functions required to implement this transformation. GRA

N86-27945# Softech, Inc., Waltham, Mass.
ADA (TRADE NAME) TRAINING CURRICULUM. ADVANCED ADA TOPICS L305 TEACHER'S GUIDE
1986 79 p
(Contract DAAB07-83-C-K506)
(AD-A165288; AD-F630715) Avail: NTIS HC A05/MF A01 CSCL 05/9

There are far more exercises in this booklet than can be solved during one presentation of L305. The instructors should select specific exercises for the class based on the class's mathematical background and programming ability, the pace of the course, and the degree of success solving previous exercises. The purpose of this Guide is to help instructors make this selection. Each exercise is designed for a certain point in the course. An accompanying diagram shows the point at which each exercise can be assigned. In most cases the exercise makes use of information presented as part of the indicated topic, and should be assigned after that topic has been presented. Because L305 emphasizes data abstraction and the construction of software out of components, solutions to most of the exercises are packages rather than subprograms. Thus they are not executable by themselves. GRA

N86-27946*# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE ISEE-3 ULEWAT: FLUX TAPE DESCRIPTION AND HEAVY ION FLUXES 1978-1984
G. M. Mason (Maryland Univ., College Park.) and B. Klecker Dec. 1985 325 p Partly in ENGLISH and FRENCH
(Contracts NAS5-26739; BMFT-RV-14-B8/74; BMFT-0101-ZA/WF/WRD-174/4)
(NASA-CR-177269; NAS 1.26:177269; MPE-IN-Rept-46; ISSN-0340-8922; EPA-86-96935) Avail: NTIS HC A14/MF A01

The ISEE ULEWAT FLUX tapes contain ULEWAT and ISEE pool tape data summarized over relatively long time intervals (1hr) in order to compact the data set into an easily usable size. (Roughly 3 years of data fit onto one 1600 BPI 9-track magnetic tape). In making the tapes, corrections were made to the ULEWAT basic data tapes in order to, remove rate spikes and account for changes in instrument response so that to a large extent instrument fluxes can be calculated easily from the FLUX tapes without further consideration of instrument performance. ESA

62 COMPUTER SYSTEMS

Includes computer networks.

N86-27947*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HYBRID ROUTING TECHNIQUE FOR A FAULT-TOLERANT, INTEGRATED INFORMATION NETWORK
Barry D. Meredith Jul. 1986 20 p
(NASA-TP-2605; L-16034; NAS 1.60:2605) Avail: NTIS HC A02/MF A01 CSCL 09B

The evolutionary growth of the space station and the diverse activities onboard are expected to require a hierarchy of integrated, local area networks capable of supporting data, voice, and video communications. In addition, fault-tolerant network operation is necessary to protect communications between critical systems attached to the net and to relieve the valuable human resources onboard the space station of time-critical data system repair tasks. A key issue for the design of the fault-tolerant, integrated network is the development of a robust routing algorithm which dynamically selects the optimum communication paths through the net. A routing technique is described that adapts to topological changes in the network to support fault-tolerant operation and system evolvability. Author

N86-27948# Sistemi di Teleinformatica ed Automazione, Rome (Italy).
ADVANCED DATA SYSTEM INTERCONNECTION STUDY Final Report
Paris, France ESA 8 Jun. 1985 82 p Revised Prepared in cooperation with MATRA Espace, Toulouse, France
(Contracts ESTEC-6017/84-NL-BI; SESA-2066-S)
(IS-23-003-Rev; ESA-CR(P)-2121-Rev) Avail: NTIS HC A05/MF A01

Onboard data management system requirements were re-

viewed. The study includes the identification of the services to be provided to the end users, the analysis of the data communication network architectures, and the design of the data system specification according to space environment constraints. The logical approach and the three axis matrix analysis prove to be well suited with regard to result validation processes. The results include the distribution of communication services into architectural layers, a definition of interfaces with the physical supports, and a mapping of architectural layers into physical equipment. The study is considered a basic step for the functional specifications toward the implementation of the communication architecture.
Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N86-27949# Pattern Analysis and Recognition Corp., McLean, Va.
COGNITIVE FACTORS IN USER/EXPERT SYSTEM INTERACTION
Paul E. Lehner and Deborah A. Zirk Oct. 1985 39 p
(Contract N00014-83-C-0537)
(AD-A165270; PAR-85-107) Avail: NTIS HC A03/MF A01 CSCL 06/4

A cognitive theory of user/expert system interaction is proposed that relates the quality of cooperative problem solving with an expert system to: (1) cognitive consistency, the degree of consistency between the rule-based system and the user's problem solving processes; and (2) mental model, the user's conceptual understanding of the basic principle of the system's problem solving processes. An experimental study is described that strongly supports the theoretical prediction. In particular, the results support the prediction that for users with an accurate mental model, increasing cognitive consistency significantly decreases user/expert system problem solving performance. Users not possessing an accurate mental model reach higher performance when utilizing cognitive consistent procedures. The practical implications of this theory are briefly discussed. GRA

N86-27950# Dynamic Systems, Inc., Urbana, Ill.
LEADER-FOLLOWER STRATEGIES UNDER MODELING AND INFORMATION UNCERTAINTIES Final Technical Report
26 Apr. 1986 260 p
(Contract DE-AC01-81RA-50658)
(DE86-000203; DOE/RA-50658/T1) Avail: NTIS HC A12/MF A01

Focus of the research is the characterization and formulation of control strategies for large-scale systems which have two or more decision making authorities. The actions of each decision maker contribute to the total behavior of the system. Furthermore, the information on which each decision maker is based is affected by the action of the other decision makers. Thus the role of multiple decision making in the theory and methodology pertaining to the analysis, planning, and control of large-scale systems is very significant. This research addressed the central influence of hierarchical organizational forms in developing control strategies in large-scale systems when the decision makers do not have identical capabilities, priorities, and information structures. This report is divided into five parts corresponding to the five tasks for the project: global feedback, adaptive control concepts, multiparameter singularly perturbed systems with multiple decision makers, multitime scales induced by the information pattern, and problems of control organizations where the organizational center is the leader and the agents are followers. DOE

N86-27951# Idaho National Engineering Lab., Idaho Falls.
EXPERT SYSTEM INTERACTION WITH EXISTING ANALYSIS CODES
V. H. Ransom, R. K. Fink, W. J. Bertch, and R. A. Callow 1986 7 p Presented at the Phoenix Conference on Computers and Communications, Phoenix, Ariz., 26 Mar. 1986
(Contract DE-AC07-76ID-01570)
(DE86-002357; EGG-M-17685; CONF-860346-1) Avail: NTIS HC A02/MF A01

Coupling expert systems with existing engineering analysis codes is a promising area in the field of artificial intelligence. The added intelligence can provide for easier and less costly use of the code and also reduce the potential for code misuse. This paper will discuss the methods available to allow interaction between an expert system and a large analysis code running on a mainframe. Concluding remarks will identify potential areas of expert system application with specific areas that are being considered in a current research program. The difficulty of interaction between an analysis code and an expert system is due to the incompatibility between the FORTRAN environment used for the analysis code and the AI environment used for the expert system. Three methods, excluding file transfer techniques, are discussed to help overcome this incompatibility. The first method is to link the FORTRAN routines to the LISP environment on the same computer. Various LISP dialects available on mainframes and their interlanguage communication capabilities are discussed. The second method involve s network interaction between a LISP machine and a mainframe computer. Comparisons between the linking method and networking are noted. The third method involves the use of an expert system tool that is campatible with a FORTRAN environment. Several available tools are discussed. With the interaction methods identified, several potential application areas are considered. Selection of the specific areas that will be developed for the pilot project and applied to a thermal-hydraulic energy analysis code are noted. DOE

N86-27952# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
THE NONINTERACTING CONTROL PROBLEM FOR NONLINEAR CONTROL SYSTEMS
H. Nijmeijer and J. M. Schumacher (Erasmus Univ., Rotterdam (Netherlands).) Mar. 1984 25 p
(Contract BMFT-0101-ZA/WF/WRD-174/4)
(Memo-427; ESA-86-96962) Avail: NTIS HC A02/MF A01

The noninteracting control problem for affine nonlinear control systems is studied, assuming that the number of scalar inputs equals the number of vector outputs, in order to find a static state feedback law for the system which achieves noninteraction. By using the differential geometric approach to nonlinear systems theory, necessary and sufficient conditions for the solution of this problem are given. In this way the approach fits in the systematic generalization of the geometric approach to linear systems theory. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N86-27953*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MODIFIED DENAVIT-HARTENBERG PARAMETERS FOR BETTER LOCATION OF JOINT AXIS SYSTEMS IN ROBOT ARMS
L. Keith Barker Washington Jul. 1986 30 p
(NASA-TP-2585; L-16092; NAS 1.60:2585) Avail: NTIS HC A03/MF A01 CSCL 12A

The Denavit-Hartenberg parameters define the relative location of successive joint axis systems in a robot arm. A recent justifiable criticism is that one of these parameters becomes extremely large when two successive joints have near-parallel rotational axes. Geometrically, this parameter then locates a joint axis system at an excessive distance from the robot arm and, computationally, leads to an ill-conditioned transformation matrix. In this paper, a

simple modification (which results from constraining a transverse vector between successive joint rotational axes to be normal to one of the rotational axes, instead of both) overcomes this criticism and favorably locates the joint axis system. An example is given for near-parallel rotational axes of the elbow and shoulder joints in a robot arm. The regular and modified parameters are extracted by an algebraic method with simulated measurement data. Unlike the modified parameters, extracted values of the regular parameters are very sensitive to measurement accuracy. Author

N86-27954# Suomalainen Tiedeakatemia, Helsinki (Finland).
ON THE DEGREE THEORY FOR NONLINEAR MAPPINGS OF MONOTONE TYPE Thesis
Juha Berkovits and Olli Lehto 1986 62 p
(ISSN-0355-0087; ISBN-951-41-0520-6) Avail: NTIS HC A04/MF A01

Many problems in mathematics and mathematical physics can be reduced to a study of the set of solutions for an equation f(x) = y, where f is a map between appropriate spaces X and Y, and y is an element of Y. Useful information about the solution set is obtained by means of a topological degree theory. One use of degree theory is to provide a natural technique for proving the so-called mapping theorems which include results concerning the invariance of domain and generalization of the Jordan curve theorem. This paper focuses on how the degree theory can be used to deduce existence and surjectivity results for equations involving nonlinear mappings of monotone type. The degree of a composition of mappings is studied and a generalization of the multiplication theorem of the Leray-Schauder theory is achieved. Finally, the connectedness of the solution set and the existence of multiple solutions are examined. M.G.

N86-27955# Naval Postgraduate School, Monterey, Calif.
A MATHEMATICAL MODEL FOR CALCULATING NON-DETECTION PROBABILITY OF A RANDOM TOUR TARGET M.S. Thesis
Salah I. AbdEl-Fadeel Dec. 1985 71 p
(AD-A165019) Avail: NTIS HC A04/MF A01 CSCL 12/1

The primary objective of this thesis was to build a mathematical model to predict the probability of a target moving according to a two-dimensional random tour model avoiding detection (i.e., surviving) to some specified time, t. This model assumes that there is a stationary searcher having a 'cookie-cutter' sensor located in the center of the search area. A Monte-Carlo simulation computer program was used to generate the non-detection probabilities. The output of this program was used to construct the required mathematical model. The model predicts, and simulation supports, that as the mean segment length of the random tour becomes small with respect to the square root of the area size, the probability of non-detection approaches that previously obtained for a diffusing target. In the opposite extreme, the probability of non-detection approaches the general form of Koopman's random search formula. Author (GRA)

N86-27956# Dayton Univ., Ohio.
A HYBRID-ITERATIVE TECHNIQUE FOR COMPLEX SCATTERING PROBLEMS Interim Report, May 1984 - May 1985
P. K. Murthy, Kuei-Chien C. Shill, and Gary A. Thiele Jan. 1986 59 p
(Contract F19628-83-K-0034)
(AD-A165233; UDR-TR-85-56; RADC-TR-85-160) Avail: NTIS HC A04/MF A01 CSCL 12/1

A new technique, named a hybrid-iterative technique, is presented which computes the induced currents on an arbitrary, perfectly conducting scatterer. The technique is an evolution from two previous techniques developed earlier. The first of the previous techniques used the moment method to compute correction currents to an optics-type current. The second of the previous techniques, which was developed on this contract, effected a significant improvement by eliminating the use of the moment method to obtain the correction currents, using iteration to obtain them. The technique described here incorporates the edge diffraction theory and the Fock theory into the ansatz of the iterative scheme. This procedure speeds up the algorithm as well as extending the range of problems that can be solved by the iterative scheme. Furthermore, the technique described in this report incorporates the correction currents into the optics currents thereby substantially reducing the computation time. For intermediate size and larger bodies, the CPU time is significantly less than that of the moment method. Results are presented for a variety of curved and edged two-dimensional cylinders. Author (GRA)

N86-27957# California Univ., Berkeley. Lawrence Berkeley Lab. School of Education.
INTERPRETATION OF SCIENTIFIC OR MATHEMATICAL CONCEPTS: COGNITIVE ISSUES AND INSTRUCTIONAL IMPLICATIONS Technical Report, Aug. 1983 - Feb. 1986
Frederick Reif Feb. 1986 45 p
(Contract N00014-83-K-0598; Grant NSF MDR-85-50332)
(AD-A165245) Avail: NTIS HC A03/MF A01 CSCL 05/10

Scientific and mathematical concepts are significantly different from every day concepts and are notoriously difficult to learn. It is shown that particular instances of such concepts can be identified or generated by different possible modes of concept interpretation. Some of these modes use formally explicit knowledge and thought processes, others rely on various kinds of compiled knowledge. Each mode has distinctive consequences in terms of attainable precision, likely errors, and ease of use. A combination of such modes can be exploited to formulate an ideal model for interpreting scientific concepts so as to achieve both reliable scientific effectiveness and cognitive processing efficiency. This model can be compared with the actual concept interpretations of expert scientists or novice students. All the preceding remarks are illustrated in the specific case of the physics concept acceleration. The discussion elucidates both cognitive and metacognitive reasons why the learning of scientific or mathematical concepts is difficult. It also suggests instructional methods for teaching such concepts more effectively. Author (GRA)

N86-27958# Sandia National Labs., Albuquerque, N. Mex.
ETBFCT: A SOLVER FOR 1-DIMENSIONAL TRANSPORT EQUATIONS
R. J. Gross and M. R. Baer Oct. 1985 48 p
(Contract DE-AC04-76DP-00789)
(DE86-002016; SAND-85-1273) Avail: NTIS HC A03/MF A01

A robust numerical technique for solving a wide class of one-dimensional transport-dominated problems is presented. The method is a finite-difference technique called flux-corrected transport (FCT) that preserves stability without sacrificing accuracy by exploiting the property of positivity. The specific algorithm, ETBFCT, developed at the Naval Research Laboratory, has been vectorized for execution on the Cray Computer. A single call to ETBFCT solving a transport equation on a 100 node mesh typically takes less than 0.001 cpu second on the Cray. ETBFCT has been modularized to be used as a library routine. The methodology and theory of FCT is discussed, enabling the potential user to make an informed judgment as to the usefulness of the method. The routines comprising the FCT algorithm and the mechanics for their use are then described. Finally, two example transport problems are solved to illustrate the use of ETBFCT. FORTRAN listings of the algorithm are included. DOE

N86-27959# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
APPROXIMATIONS TO TOROIDAL HARMONICS
P. A. Pribyl Oct. 1985 81 p
(Contract DE-AC02-78ET-51013)
(DE86-003358; DOE/ET-51013/161; PFC/RR-85-21) Avail: NTIS HC A05/MF A01

Toroidal harmonics P sup 1 sub n-1/2 (cosh mu) and Q sup 1 sub n-1/2 (cosh mu) are useful in solutions to Maxwell's equations in toroidal coordinates. In order to speed their computation, a set of approximations has been developed that is valid over the range 0 < mu< infinity. The functional form used for these approximations is dictated by their behavior as mu yields 0 and as mu yields infinity, and is similar to that used by Hastings in his

approximations to the elliptic integrals K and E. This report lists approximations of several mathematical forms with varying numbers of terms; approximations to the above Legendre functions are given for n = 0 through 6. Coefficients of each expansion have been adjusted to distribute the relative error in equi-amplitude peaks over some range, typically .05 < mu< 5, and in the best cases these peaks are less than 10 to the -10 power. The simple method used to determine the approximations is described. Relative error curves are also presented, obtained by comparing approximations to the more accurate values computed by direct summation of the hypergeometric series. DOE

N86-27960# Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Applied Mathematics.
TWISTOR GEOMETRY
P. M. vandenBroek Jul. 1984 54 p
(Contract BMFT-0101-ZA/WF/WRD-174/4)
(Memo-410; ESA-86-96961) Avail: NTIS HC A04/MF A01

The relation between the geometry of twistor space and the geometry of Minkowski space is exposed. The concepts of Minkowski space, Lorentz group, SL(2,C), spinors, and the interrelations between them are recalled. Null twistors are interpreted as null lines in compactified Minkowski space. General twistors are interpreted as Robinson congruences in compactified Minkowski space and as null planes in compactified complexified Minkowski space. It is shown how these interpretations are related. Ways in which the conformal group acts on twistor space are discussed. ESA

N86-27961# National Oceanic and Atmospheric Administration, Seattle, Wash. Marine Environmental Lab.
SIMULATION DATA SETS FOR TESTING MOS (MODEL OUTPUT STATISTICS) PREDICTION METHODS
R. W. Preisendorfer Oct. 1985 60 p
(PB86-173911; NOAA-TM-ERL-PMEL-65) Avail: NTIS HC A04/MF A01 CSCL 12A

It is shown how to construct a set of time series with prescribed autocorrelations and cross correlations which will serve as simulators of real fields drawn from nature for use in testing methods of prediction. These constructions are applied in particular to the problem of evaluating the skill of prediction methods in the context of a model output statistics (MOS) framework. In an MOS framework there are three main ingredients: (1) a model that produces a set of predictor time series called the model predictors; (2) an observer that produces the observed predictand, and (3) a prediction method that forecasts the predictand given the predictors. The distinguishing feature of an MOS framework is that the observed predictands are not in the list of outputs of the model. It therefore falls upon the prediction method to link the model predictors and the observed predictand during a training period for the method. Then, when fresh realizations of the predictors are produced by the model, the prediction method will produce its forecasts of the predictand. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N86-27962# Connecticut Univ., Storrs. Dept. of Electrical Engineering and Computer Sci.
TARGET PARAMETER ESTIMATION IN THE NEAR-FIELD WITH TWO SENSORS Annual Report, 1984 - 1985
H. Shertukde and Y. Bar-Shalom Jan. 1986 47 p
(Contract N00014-84-K-0492)
(AD-A165237; TR-86-2) Avail: NTIS HC A03/MF A01 CSCL 17/7

A performance prediction procedure is developed for the evaluation of a passive tracking technique for the localization of targets in the near-field of the sensors. The target moves in a three-dimensional space with a constant velocity at a constant depth. The parameter vector is thus five-dimensional. Target localization parameter identifiability is established with the aid of the Fisher Information Matrix (FIM). The FIM is evaluated for various combinations of the following sequences of measurements: time difference of arrival (TDOA) between the two sensors, depression angles measured at the two sensors, and frequency measurements obtained separately with the two sensors. The FIM is used to determine bounds on localization performance, and the corresponding uncertainty ellipses associated with the target position are evaluated for various tracking scenarios. The theoretical results are corroborated by applying a maximum likelihood estimation algorithm to simulated data and observing the results for a series of Monte Carlo simulations. Author (GRA)

N86-27963# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
THE USE OF CONVERSATIONAL PACKAGES IN STATISTICAL COMPUTING
H. J. Ader (Vrije Universiteit, Amsterdam (Netherlands).), D. J. Kuik, E. Opperdoes (Central Bureau of Statistics, Voorburg (Netherlands).), and B. F. Schriever (Vrije Universiteit, Amsterdam (Netherlands).) Sep. 1985 37 p Partly in ENGLISH and FRENCH Submitted for publication
(Contract BMFT-0101-ZA/WF/WRD-174/4)
(CWI-MS-R8506; ESA-86-96985) Avail: NTIS HC A03/MF A01

Problems which arise when applying statistical techniques repeatedly on the same dataset are outlined. Protection of inexperienced users against this kind of improper use of a conversational statistical package is discussed. Formal aspects of conversational communication are listed. User objectives in the use of the package are considered and consequences for the user interface formulated. ESA

N86-27964# Research Triangle Inst., Research Triangle Park, N.C.
DETERMINING UNCERTAINTY IN PHYSICAL PARAMETER MEASUREMENTS BY MONTE CARLO SIMULATION
D. W. Coy, G. A. Kew, M. E. Mullins, and P. V. Piserchia Mar. 1986 30 p
(Contract EPA-68-03-3149)
(PB86-164902; EPA/600/D-86/052) Avail: NTIS HC A03/MF A01 CSCL 13B

A statistical approach, often called Monte Carlo Simulation, was used to examine propagation of error with measurement of several parameters important in predicting environmental transport of chemicals. These parameters are vapor pressure, water solubility, octanol-water partition coefficient, and volatilization from water. Column chromatographic and high pressure liquid chromatographic methods tend to under predict aqueous solubility and vapor pressure and overpredict octanol-water partition coefficient. Measurement error proves not to be normally distributed, with differing bias for each parameter. For volatilization from water, determination of the ratio of rate constants for compounds whose Henry's Law constant equals or exceeds 1,000 torr/mole/liter typically report 95% confidence limits equal to 5 to 10 percent of the ratio. Analysis of a regression approach often used to determine the ratio suggests underestimation of both the ratio and its variance. Monte Carlo Simulation did not confirm underestimation of the ratio but suggests variances may be underestimated by a factor of 2.3. Using the statistical approach in other cases might allow an investigator to choose levels of a parameter knowing the uncertainly associated with the choice, or the converse. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N86-27965# Florida Univ., Gainesville. Dept. of Statistics.
THE SEQUENTIAL GENERATION OF MULTIRESPONSE D-OPTIMAL DESIGN WHEN THE VARIANCE-COVARIANCE MATRIX IS NOT KNOWN
Manel C. Wijesinha and Andre I. Khuri Feb. 1986 25 p
(Contract N00014-86-K-0059)
(AD-A164731; TR-258) Avail: NTIS HC A02/MF A01 CSCL 12/1

The construction of D-optimal designs for multiresponse experiments was previously considered. This algorithm required that the variance covariance matrix, Sigma, of the responses be known. This is rarely the case in practice. The primary objective of this paper is to develop a sequential procedure for the construction of multiresponse designs when Sigma is not known. Several numerical examples are given to illustrate this procedure.
GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N86-27966# Polish Academy of Sciences, Warsaw. Instytut Podstawowych Problemow Techniki.
THE 1/2 SUBHARMONIC RESONANCE AND ITS TRANSITION TO CHAOTIC MOTION IN A NONLINEAR OSCILLATOR
Wanda Szemplinska-Stupnicka, Josef Bajkowski, and Zaklad Ukladow Meohanioznych Apr. 1986 37 p
(ISSN-0208-5658) Avail: Issuing Activity

An equation of motion representing steady-state vibrations of physical systems with nonsymmetric elastic characteristics and single equilibrium conditions is considered. The results of theoretical, first approximate solution and computer simulation are presented and the following conclusions are drawn: (1) the system can exhibit chaotic motion in a narrow zone of frequency in the neighbourhood of nu(D sub 1), where the theoretical loss of stability of the 1/2 subharmonic resonance is predicted; (2) although the chaotic motion is preceded by a cascade of period doubling bifurcations, the three harmonic components assumed in the first approximate solution predominate in the response as long as the motion is a regular, periodic one; (3) the region of chaotic motion replaces the classical 'jump phenomenon' and forms a transition zone between the subharmonic and resonant harmonic solution; and (4) the chaotic motion exhibited by the system can be roughly interpreted as random fluctuation of the 1/2 nu harmonic component.
M.G.

N86-27967# Academy of Sciences (USSR), Moscow. Space Research Inst.
SATURATE COMPTONIZATION IN THE STRONG MAGNETIC FIELD
Yu. E. Lyubarsky 1986 20 p
(Rept-1086) Avail: NTIS HC A02/MF A01

The radiation transfer in a hot optically thick plasma with a strong magnetic field (gamma sub g >> gamma) is considered assuming the scattering to dominate the absorption. The conditions of saturated Comptonization imply the characteristic time for energy gain by photon, due to multiple Compton scatterings, to be much less than escape time. Then the Wien spectrum forms with chemical potential depending on the depth according to the rates of photon production and escape. The analytical expressions for the radiation flux emitted by the semi-infinite isothermal medium, and the spectrum and angular distribution of outcoming radiation are obtained.
Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environment Pollution*.

N86-27968 ESDU International Ltd., London (England).
COMPUTER-BASED ESTIMATION PROCEDURE FOR CO-AXIAL JET NOISE, INCLUDING FAR-FIELD SUBSONIC JET MIXING NOISE DATABASE FOR STATIONARY, CO-PLANAR CONICAL NOZZLES
Dec. 1985 76 p
(ESDU-85043; ISBN-0-85679-549-6; ISSN-0307-0115) Avail: ESDU

Data item ESDU 85043, Noise Sub-Series, provides a program lisiting for interpolating within or extrapolating a data base. The variables considered make it particularly applicable in estimating noise from coaxial jets. A comprehensive data base is provided for jet mixing noise of static engines with conical nozzles, but the user may provide an alternative data base that could include installation and flight effects as well as other noise components (such as combustion and shock noise) or may supplement the provided data base with additional data. The interpolation/extrapolation routine uses a least squares fitting procedure in which two or three independent variables may be involved. Two of the variables are the primary jet velocity and the velocity ratio of the two streams but the third may be chosen by the user. Appropriate weighting of the data is included. The program is listed in both BASIC and FORTRAN.
ESDU

N86-27969# Federal Aviation Administration, Washington, D.C.
ADVISORY CIRCULAR: ESTIMATED AIRPLANE NOISE LEVELS IN A-WEIGHTED DECIBELS
27 Mar. 1986 38 p
(AC-36-3D) Avail: NTIS HC A03/MF A01

Federal Aviation Regulation (FAR) Part 36 requires the reporting of turbojet and large transport category aircraft certificated noise levels in units of Effective Perceived Noise Level in decibels. Many airport and other community noise analyses utilize a noise rating scale that is based upon A-weighted decibels. For this reason, A-weighted noise levels for aircraft under FAR Part 36 conditions were estimated to provide a reference source for aircraft noise levels that is consistent with the many noise rating scales having A-weighted noise level as the basic measurement. Listings of estimated aircraft noise levels in units of A-weighted sound level in decibels, ranked in descending order are presented. This information is provided both for aircraft that were noise type certificated under FAR Part 36 and for aircraft for which no such requirement currently exists.
Author

N86-27970*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPECTRA OF NOISE AND AMPLIFIED TURBULENCE EMANATING FROM SHOCK-TURBULENCE INTERACTION: TWO SCENARIOS
Herbert S. Ribner Mar. 1986 40 p Sponsored by the Natural Sciences and Engineering Research Council of Canada Prepared in cooperation with Toronto Univ. (Ontario)
(NASA-TM-88766; NAS 1.15:88766; UTIAS-TN-260;
ISSN-0082-5263) Avail: NTIS HC A03/MF A01 CSCL 20A

This work is a small extension of NACA studies of the early fifties that predicted amplification of turbulence on passing through a shock wave (observed for turbulent boundary layers), as well as the generation of intense noise (observed for supersonic jets). The first solved the basic gasdynamics problem of the interaction of an infinite planar shock with a single three-dimensional spectrum component of turbulence (an oblique sinusoidal shear wave). The second developed the comprehensive 3D spectrum analysis necessary to generalize the scenario to the interaction of a shock wave with convected homogeneous turbulence. Numerical calculations were carried out to yield curves (vs. Mach number) of rms sound pressure, temperature fluctuation, and two components of turbulent velocity downstream of the shock, for two cases of preshock turbulence. The present numerical study reproduces

these for one case and provides in addition their one-dimensional power spectra (vs. wavenumber or frequency). Ratios of the several postshock spectra to the longitudinal preshock turbulence spectrum (1D) have been computed for a wide range of Mach numbers; curves vs. wavenumber are presented for two scenarios of preshock turbulence: isotropy and axisymmetry, both based on the von Karman 3D spectrum. Author

N86-27971# Princeton Univ., N. J. Information Sciences and Systems Lab.
SIGNAL DETECTION AND NORMALIZATION IN UNDERWATER NOISES MODELED AS A GAUSSIAN-GAUSSIAN MIXTURE Technical Report, Sep. 1984 - Aug. 1985
Michel Bouvet and Stuart C. Schwartz Jan. 1986 61 p
(Contract N00014-81-K-0146)
(AD-A164876; TR-18) Avail: NTIS HC A04/MF A01 CSCL 09/4

Knowledge of the noise probability density function is central in signal detection problems, not only for optimum receiver structures but also for processing procedures such as power normalization. The statistical knowledge must be acquired since the classical assumption of a Gaussian noise PDF is often not valid in underwater acoustics. This report studies statistical modeling by a Gaussian-Gaussian mixture for three different underwater noise samples. One of them can adequately be described by a Gaussian-Gaussian mixture, one is very close to a Gaussian model and is described by a mixture with a very small perturbating term, whereas the third one seems closer to the Middleton class A model but is non-stationary. The first noise is studied with emphasis on the normalization needed in the receiver in order to achieve a constant false alarm probability and also on the optimal receiver structure for the detection of a deterministic signal. It is shown that the classical noise power estimate, calculating the norm L-squared of the observation vector, is a good approximation to the square of the maximum likelihood estimator of the noise amplitude for the Gaussian-Gaussian mixture. GRA

N86-27972# Federal Aviation Administration, Washington, D.C. Office of Environment and Energy.
ANALYSIS OF HELICOPTER NOISE DATA USING INTERNATIONAL HELICOPTER NOISE CERTIFICATION PROCEDURES
J. S. Newman, E. J. Rickley, D. A. Levanduski, and S. B. Woolridge Mar. 1986 282 p Prepared in cooperation with Operations Research, Inc., Rockville, Md.
(PB86-186533; FAA-EE-86-01) Avail: NTIS HC A13/MF A01 CSCL 20A

The results of a Federal Aviation Administration (FAA) noise measurement flight test program involving seven helicopters are documented. Noise levels were established using the basic testing, reduction and analysis techniques specified by the International Civil Aviation Organization (ICAO) for helicopter noise certification, supplemented with some procedural refinements contained in ICAO Working Group II recommendations for incorporation into the standard. GRA

N86-27473# Columbia Univ., New York. Dept. of Civil Engineering.
NOISE TRANSMISSION INTO PROPELLER AIRCRAFT Monthly Report
R. Vaicaitis *In* Shock and Vibration Information Center(Defense), The Shock and Vibration Digest, Volume 17, No. 8 , Aug. 1985 p 15-20 (For primary document see N86-27471 18-31)
Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20/11

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N86-27973# Texas Univ., Austin.
RESEARCH IN EXPERIMENTAL NUCLEAR PHYSICS Progress Report, 1 Apr. 1985 - 31 Mar. 1986
Nov. 1985 10 p
(Contract DE-AS05-76ER-05224)
(DE86-000864; DOE/ER-05224/9) Avail: NTIS HC A02/MF A01

An overview of experiments performed at LAMPF on the Energetic Pion Channel and Spectrometer (EPICS) or at the High Resolution Spectrometer (HRS) is presented. A list of abstracts of papers reported at scientific meetings and a list of published papers is given. DOE

N86-27974# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Nuclear Physics Section.
[NUCLEAR REACTIONS]
1985 47 p Presented at Workshop on Perspectives in Nucl. Phys. at Intermediate Energies, Miramare-Trieste, Italy, 25-29 Mar. 1985
(EMIN-85-04; B8574262; ESA-86-97017) Avail: NTIS HC A03/MF A01

Delta excitation in nuclei by pions and photons; a nuclear structure research program; and high resolution (e, e', p) experiments are discussed. For individual titles, see N86-27975 through N86-27977.

N86-27975# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands). Sectie-K.
DELTA-EXCITATION IN NUCLEI BY PIONS AND PHOTONS
Justus H. Koch *In its* Nuclear Reactions 1985 14 p Sponsored by Foundation for Fundamental Research on Matter and Netherlands Organization for the Advancement of Pure Research (For primary document see N86-27974 18-72)
Avail: NTIS HC A03/MF A01

The delta-hole approach was used to study pion and photon-induced nuclear reactions at intermediate energies. It is shown that the many body aspects of delta-propagation in nuclei play a very important role in photonuclear reactions, including nuclear photoabsorption, elastic Compton scattering, and pion photoproduction. There are discrepancies in the peak height and position between the calculated and measured photoabsorption cross sections for light targets. For elastic nuclear Comptom scattering in the resonance region, which provides another probe of the delta-nucleus dynamics, no data exist. Nuclear pion photoproduction measurements are quite well described in the delta-hole approach, which includes important medium modifications of the production process. ESA

N86-27976# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
FUTURE DEVELOPMENTS AT NATIONAL INSTITUT VOOR KERNFYSICA EN HOGE-ENERGIEFYSICA (NIKHEF)-K, AMSTERDAM
C. deVries *In its* Nuclear Reactions 1985 13 p Sponsored by Foundation for Fundamental Research on Matter and Netherlands Organization for the Advancement of Pure Research (For primary document see N86-27974 18-72)
Avail: NTIS HC A03/MF A01

A nuclear-structure research program with electron and photon beams is described. High-resolution single-arm electron scattering experiments investigate properties of nuclear ground states and discrete energy levels. High missing-mass resolution (150 keV) coincidence experiments involving quasi elastic knockout processes, such as (e,e'p) and (e,e'd), investigate wave functions of individual nucleons and nucleon clusters in the nucleus. Photopion production experiments study pion-nucleus delta resonance effects. Electron scattering experiments at 180 deg study ground state magnetic moment distributions and magnetic and transverse-electric transitions. ESA

N86-27977# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
HIGH RESOLUTION (E, E', P) EXPERIMENTS
P. K. A. deWittHuberts *In its* Nuclear Reactions 1985 18 p (For primary document see N86-27974 18-72)
Avail: NTIS HC A03/MF A01

Deep proton-hole states were studied using electromagnetic probes, in the quasi elastic knockout process (e, e', p). The relative lack of two-step processes in the (e,e'p) reaction is demonstrated for the case of C12; based on this observation, information on small wave function components was obtained from the one-step dominated (e,e'p) reaction. The coupling of the virtual photon with correlated (p-n) pairs was investigated with the (e,e'd) reaction on He3. Coupling is found to be appreciable and to agree with a diagrammatic expansion of the scattering amplitude, including initial and final state correlations. The treatment of the final state interaction in an optical model framework is schematic and leads to a non-negligible uncertainty in the absolute spectroscopic factors. ESA

N86-27978# Rome Air Development Center, Griffiss AFB, N.Y.
THE DE BROGLIE RELATIONS: LORENTZ INVARIANCE AND PHOTONS Report, Jan. - Jun. 1985
Ronald G. Newburgh Aug. 1985 22 p
(AD-A165234; RADC-TR-85-144) Avail: NTIS HC A02/MF A01 CSCL 20/10

A simple covariant derivation of the de Broglie relations breaks down when one considers propagation of light in an anisotropic medium. This breakdown results in two disappointing conclusions. The first is that the de Broglie relations are not completely universal and their covariance is restricted. The second is that wave-particle duality is not universal. In this paper a resolution of these problems is suggested, a resolution which is an extrapolation of ideas of de Broglie and Andrade e Silva. The relations are generalized for propagation in anisotropic media by defining a new phase wave with wave vector I in the direction of energy transport and distinct from the conventional electromagnetic wave. The introduction of I follows the method by which de Broglie associated a wave with an electron. The magnitude of I is omega u/c-squared where omega is the angular frequency and u the velocity of energy transport. The physical meaning of I and the covariance of physical laws in the presence of matter are discussed. An experiment is described which would test the existence of the phase wave associated with the new wave vector I. This experiment is essentially a Young two-slit experiment carried out within an anisotropic crystal. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N86-27979# Lawrence Livermore National Lab., Calif.
NUMERICAL SIMULATION OF SECONDARY ELECTRON ORBITS NEAR AN ELECTRON BEAM PROPAGATING IN A LOW PRESSURE GAS
M. R. Teague and S. S. Yu 14 Aug. 1985 10 p Presented at the Particle Accelerator Conference, Vancouver, British Columbia, 13 May 1985
(Contract W-7405-eng-48)
(DE86-001651; UCRL-91956; CONF-850504-296) Avail: NTIS HC A02/MF A01

A numerical simulation has been constructed to obtain a detailed, quantitative estimate of the electromagnetic fields generated in a recently-proposed collective accelerator scheme for electrons. The code treats the secondary electrons by particle simulation and the beam dynamics by a time-dependent envelope model. The simulation gives a fully relativistic description of secondary electrons moving in selfconsistent electromagnetic fields. The calculations are made using coordinates t, x, y, z for the electrons and t, ct-z, r for the axisymmetric electromagnetic fields and currents. Code results showing the axial electric field dependence on the configuration of the ultrashort U.V. laser pulse will be given. DOE

N86-27980# Sandia National Labs., Albuquerque, N. Mex.
NINTH INTERNATIONAL NEA SEABED WORKING GROUP MEETING
D. R. Anderson Aug. 1985 162 p Meeting held in Berlin, West Germany, 27-29 Mar. 1984
(Contract DE-AC04-76DP-00789)
(DE85-017595; SAND-84-1451; CONF-8403207) Avail: NTIS HC A08/MF A01

This report is an account of work sponsored by the Governments of Canada, France, the Federal Republic of Germany, Japan, the Netherlands, Switzerland, United Kingdom, and the United States, and by the Commission of the European Communities, in the framework of a coordinate program on seabed disposal of radioactive waste. The objective of the coordinated program is to provide an international assessment of the technical feasibility and long-term safety of seabed disposal of high-level radioactive waste as a multi-media concept with marine sediments as the primary isolation barrier. DOE

74 OPTICS

Includes light phenomena.

N86-27981# Purdue Univ., West Lafayette, Ind. School of Electrical Engineering.
COUPLING PROBLEMS WITH HIGH BIREFRINGENCE FIBERS Final Report
Chin-Lin Chen Sep. 1985 60 p
(Contract N00014-83-K-2029)
(AD-A165150) Avail: NTIS HC A04/MF A01 CSCL 20/6

A program to investigate the coupling problems of high birefringence fibers was initiated. A fiber is birefringent if it has a non-circular core and/or cladding, or is subjected to anisotropic stress. Currently, the loss of fibers with embedded anisotropic stress is much lower than that with non-circular core or cladding and therefore these fibers are of interest. Central to any coupling problem is the distribution of fields in the fibers. To date, very little is known relative to the fields of polarization modes in biaxial fibers. This is the main thrust of our study. We have used a perturbation method to study the fields and dispersion of polarization modes in biaxial fibers. In our approach, the inclusion or exclusion of a term is determined by the differential equation, the boundary conditions and the symmetry of the problem, and does not rely on the prior knowledge of the fields in the fibers. The dependence of the fiber birefringence on the index differential and index anisotropy has been studied. Now that the fields in high birefringent fiber are known, the excitation of high birefringent fibers can be analyzed. Methods for studying these excitation problems are indicated and some of the results are presented. GRA

N86-27982# Sandia National Labs., Albuquerque, N. Mex.
ACCURATE DETERMINATION OF Hg OSCILLATOR STRENGTHS BY NONLINEAR-OPTICAL MIXING
A. V. Smith and W. J. Alford 1985 3 p Presented at the International Laser Science Conference, Dallas, Tex., 18 Nov. 1985
(Contract DE-AC04-76DP-00789)
(DE86-005440; SAND-85-1678C; CONF-851185-5) Avail: NTIS HC A02/MF A01

We have developed new techniques based on four-wave mixing for accurate determination of oscillator strengths. Using index-matching conditions of the mixing process, we have obtained oscillator strengths of 15 VUV transitions in Hg. DOE

N86-27983# Gesellschaft fuer Informationsverarbeitung, Kommunikationstechnik und Prozessautomatisierung m.b.H., Stuttgart (West Germany).
OPTICAL BUS SYSTEM LIBSY Final Report, Sep. 1982
Thomas Wagner Bonn Bundesministerium fuer Forschung und Technologie Nov. 1985 50 p In GERMAN; ENGLISH summary

Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-85-123; ISSN-0340-7608; ESA-86-96890) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 10.50

The local area network LIBSY, a protocol transparent ring with controlled access consisting of users, computers, and peripherical devices all connected to an optical bus by the intelligent interface device LICOM is presented. The LICOM contains the interface electronics for a bus compatible adaption to the user computer. The battery-buffered coupling optronics connects the optical fiber and the computer which drives and supervises the decentralized democratically organized data flow in the network. Up to 64 computers or 255 users can be connected to the ring. The levels 1 to 4 of the ISO model for system architecture were implemented by the system. ESA

N86-27488# Joint Publications Research Service, Arlington, Va.
OUTPUT POWER EQUATION AND NUMERICAL INTEGRATING METHOD OF POSITIVE-BRANCH UNSTABLE CONFOCAL RESONATOR
Zuhai Cheng, Zaiguang Li, and Xuhui He *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 97-104 Transl. into ENGLISH from Guangxue Xuebao (Acta Optica Sinica) (Shanghai, China), v. 5, no. 11, Nov. 1985 p 986-991 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27496# Joint Publications Research Service, Arlington, Va.
DESIGN OF OPTICAL DETECTOR, RECEIVER DISCUSSED
Guoxiang Li and Jingde Xu *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 164-168 Transl. into ENGLISH from Dalian Gongxueyuan Xuebao (Dalian, China), v. 24, no. 3, Sep. 1985 p 121-124 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27512# Joint Publications Research Service, Arlington, Va.
TIME-RESOLVED X-RAY SPECTRA STUDIED
Chengming Pan, Guangyu Yin, Shicheng Zhao, and Daqing Zhu *In its* China Report: Science and Technology (JPRS-CST-86-009) 13 Mar. 1986 p 140-145 Transl. into ENGLISH from Zhongguo Jiguang (Shanghai, China), v. 12, no. 9, Sep. 1985 p 570-572 (For primary document see N86-27501 18-31)
Avail: NTIS HC A08/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N86-27984# Los Alamos National Lab., N. Mex.
FISSION POWER: A SEARCH FOR A SECOND-GENERATION REACTOR
J. Hovingh Jul. 1985 112 p
(Contract W-7405-eng-48)
(DE85-0174142; UCID-20015) Avail: NTIS HC A06/MF A01

This report touches on the history of US fission reactors and explores the current technical status of such reactors around the world, including experimental reactors. Its purpose is to identify, evaluate, and rank the most promising concepts among existing reactors, proposed but unadopted designs, and what can be described as new concepts. Also discussed are such related concerns as utility requirements and design considerations. The report concludes with some recommendations for possible future LLNL involvement. DOE

N86-27985# Lawrence Livermore National Lab., Calif.
PROGRESS IN INERTIAL FUSION
W. Hogan and E. Storm Oct. 1985 13 p Presented at the 7th International Workshop on Laser Interaction and Related Plasma Phenomena, Monterey, Calif. 28 Oct. 1985
(Contract W-7405-eng-48)
(DE86-003473; UCRL-92434; CONF-851053-7) Avail: NTIS HC A02/MF A01

The requirements for high gain in inertial confinement are given in terms of target implosion requirements. Results of experimental studies of the laser/target interaction and of the dynamics of laser implosion. A report of the progress of advanced laser development is also presented. DOE

N86-27986# Lawrence Livermore National Lab., Calif.
TIBER: TOKAMAK IGNITION/BURN EXPERIMENTAL RESEARCH
C. D. Henning, B. G. Logan, W. L. Barr, R. H. Bulmer, J. N. Doggett, B. M. Johnston, R. W. Hoard, J. D. Lee, J. R. Miller, D. S. Slack et al Nov. 1985 8 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985 Prepared in cooperation with Massachusetts Inst. of Tech., Cambridge
(Contract W-7405-eng-48)
(DE86-003475; UCRL-93497; CONF-851102-40) Avail: NTIS HC A02/MF A01

As part of a continuing effort by the Office of Fusion Energy to define an ignition experiment, a superconducting tokamak has been designed with thin neutron shielding and aggressive magnet and plasma parameters. By so minimizing the inner radial dimensions of the tokamak center post, coil, and shielding region, the plasma major radius is reduced, with a corresponding reduction in device costs. The peak nuclear-heating rate in the superconducting TF coils is 22 mW/cm³, which results in a steady heat load of 50 kW to the cryogenic system. Fast-wave, lower-hybrid heating would be used to induce a 10-MA current in a moderate density plasma. Then pellet fueling would raise the density to achieve ignition as the current decays in a few hundred seconds. Steady-state current drive in subignited conditions permits a 0.8 MW/m² average wall loading to study plasma and nuclear engineering effects. DOE

N86-27987# Lawrence Livermore National Lab., Calif.
MINIMARS: AN ATTRACTIVE SMALL TANDEM MIRROR FUSION REACTOR
L. J. Perkins, B. G. Logan, J. N. Doggett, R. S. Devoto, W. D. Nelson (Oak Ridge National Lab., Tenn.), D. C. Lousteau, G. L. Kulcinski (Wisconsin Univ., Madison.), J. F. Santarius, J. D. Gordon (TRW Defense and Space Systems Group, Redondo Beach, Calif.), and R. B. Campbell 13 Nov. 1985 6 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985 Prepared in cooperation with Oak Ridge National Lab., TN.;Wisconsin Univ., Madison.;TRW Energy Development Group, Redondo Beach, CA.;General Dynamics Corp., Fort Worth, TX.;Argonne National Lab., IL.
(Contract W-7405-eng-48)
(DE86-003479; UCRL-92631; CONF-851102-44) Avail: NTIS HC A02/MF A01

Through the innovative design of a novel end plug scheme employing octopole MHD stabilization, we present the conceptual design of MINIMARS, a small commercial fusion reactor based on the tandem mirror principle. The current baseline for MINIMARS has a net electric output of 600 MWe and we have configured the design for short construction times, factory-built modules, inherently safe blanket systems, and multiplexing in station sizes of approx. 600 to 2400 MWe. We demonstrate that the compact octopole end cell provides a number of advantages over the more conventional quadrupole (yin-yang) end cell encountered in the MARS tandem mirror reactor study, and permits ignition to be achieved with much shorter central cell lengths. Accordingly, being economic in small sizes, MINIMARS provides an attractive alternative to the more conventional larger conceptual fusion reactors encountered to date, and would contribute significantly to the lowering of utility financial risk in a developing fusion economy. DOE

N86-27988# Sandia National Labs., Albuquerque, N. Mex.
FLASHOVER LITHIUM ION SOURCE DEVELOPMENT FOR LARGE PULSED POWER ACCELERATORS
K. W. Bieg, E. J. T. Burns, R. A. Gerber, J. N. Olsen, and K. P. Lamppa 1985 16 p Presented at the 32nd National Vacuum Symposium and Topical Conference, Houston, Tex., 19 Nov. 1985
(Contract DE-AC04-76DP-00789)
(DE86-003499; SAND-85-2529C; CONF-851174-16) Avail: NTIS HC A02/MF A01

PBFA II, a light-ion pulsed power accelerator intended for inertial confinement fusion (ICF) applications, is currently under construction at Sandia National Laboratories. The accelerator will deliver a 30 MV, 5 MA lithium beam from an Applied-B diode to drive an ICF target. The ion source for this diode will require a thin (approx. 1 mm), dense (10.cm) anode plasma layer of singly-ionized lithium over an anode area of 10 cm. One type of source being investigated is the flashover ion source, which generates the anode plasma via vacuum flashover of a lithium-bearing dielectric material. Experiments with a LiF flashover source on the 0.03 TW Nereus accelerator have shown that contaminant ions account for as much as 70% of the extracted ion beam current. To overcome this, we have explored in-diode cleaning of the externally-prepared anode surface by flow discharge cleaning and vacuum baking as well as in-diode preparation of the anode surface by vacuum evaporation of the lithium dielectric. Lithium-bearing dielectric materials which have been investigated include LiF, LiI, LiNO, and Li N. These techniques have resulted in a two-to three-fold improvement in the extracted lithium ion purity. As a result, a glow-discharge cleaned LiF flashover source will be used for initial pulsed-power testing on PBFA II. DOE

N86-27989# Los Alamos National Lab., N. Mex.
BLANKET ACTIVATION AND AFTERHEAT FOR THE COMPACT REVERSED-FIELD PINCH REACTOR
J. W. Davidson and M. E. Battat 1985 8 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985
(Contract W-7405-eng-36)
(DE86-003669; LA-UR-85-4017; CONF-851102-36) Avail: NTIS HC A02/MF A01

A detailed assessment has been made of the activation and afterheat for a Compact Reversed-Field Pinch Reactor (CRFPR) blanket using a two-dimensional model that included the limiter, the vacuum ducts, and the manifolds and headers for cooling the limiter and the first and second walls. Region-averaged, multigroup fluxes and prompt gamma-ray/neutron heating rates were calculated using the two-dimensional, discrete-ordinates code TRISM. Activation and depletion calculations were performed with the code FORIG using one-group cross sections generated with the TRISM region-averaged fluxes. Afterheat calculations were performed for regions near the plasma, i.e., the limiter, first wall, etc. assuming a 10-day irradiation. Decay heats were computed for decay periods up to 100 minutes. For the activation calculations, the irradiation period was taken to be one year and blanket activity inventories were computed for decay times to 4 x 10 years. These activities were also calculated as the toxicity-weighted biological hazard potential (BHP). DOE

N86-27990# Los Alamos National Lab., N. Mex.
PROSPECTS FOR FUSION APPLICATIONS OF REVERSED-FIELD PINCHES
C. G. Bathke, R. A. Krakowski, and R. L. Hagenson 1985 7 p Presented at the 11th Symposium on Engineering Problems in Fusion Research, Austin, Tex., 18 Nov. 1985
(Contract W-7405-eng-36)
(DE86-003677; LA-UR-85-3984; CONF-851102-45) Avail: NTIS HC A02/MF A01

The applicability of the Reversed-Field Pinch (RFP) as a source of fusion neutrons for use in developing key fusion nuclear technologies is examined. This Fusion Test Facility (FTF) would emphasize high neutron wall loading, small plasma volume, low fusion and driver powers, and steady-state operation. Both parametric tradeoffs based on present-day physics understanding and a conceptual design based on an approx. 1-MW/m (neutron) driven operation are reported. DOE

N86-27991# Rochester Univ., N. Y. Lab. for Laser Energetics.
ABSOLUTE STIMULATED RAMAN SCATTERING INSTABILITY IN A FINITE COLLISIONAL PLASMA
C. J. McKinstrie and A. Simon 1985 17 p Presented at the 29th Annual Anomalous Absorption Conference, Banff, Alberta, 23 Jun. 1985
(Contract DE-FC08-85DP-40200)
(DE86-003778; DOE/DP-40200/14; CONF-8506221-2) Avail: NTIS HC A02/MF A01

The nonlinear saturation of the absolute stimulated Raman scattering (SRS) instability is considered in a finite homogeneous plasma. The amplitude of the incident wave exceeds the absolute instability threshold by the fractional amount ($<<1$). A single backscattered wave and a single plasma wave grow until time-asymptotic saturation occurs. The reflected light intensity is determined analytically. The spatial variation of the saturated wave amplitudes is also determined. The reflected intensity is compared to the values predicted for the convective instability, for the same incident intensity. In short plasmas, i.e., ones which extend over only a few convective gain lengths, the reflected intensity is much higher when the absolute instability threshold is exceeded. A reflection coefficient for the SRS instability is discussed for the case when both spatial and temporal effects are important. The paper consists of 15 viewgraphs. DOE

N86-27992# Rochester Univ., N. Y. Lab. for Laser Energetics.
NUMERICAL SIMULATION AND TARGET DESIGN FOR LASER-IMPLODED CYLINDRICAL PLASMAS
R. Epstein, J. Delettrez, M. C. Richardson, and B. Yaakobi 1985 19 p Presented at the 29th Annual Anomalous Absorption Conference, Banff, Alberta, 23 Jun. 1985
(Contract DE-FC08-85DP-40200)
(DE86-003780; DOE/DP-40200/15; CONF-8506221-3) Avail: NTIS HC A02/MF A01

The characteristics of plasmas formed from laser-driven implosions of cylindrical targets are studied using one-dimensional hydrocode simulations. The implosive motion of the heated target material and the axial symmetry of the plasma are properties not shared by exploding-foil plasmas. These properties can be exploited to control the plasma lifetime and transverse scale lengths which, in addition to optimum average ionization states, are important characteristics of plasmas used as X-ray laser media. The analysis includes atomic rate-equation calculations of the relevant ionization species populations within these plasmas. The paper consists of 10 viewgraphs. DOE

N86-27993# Rochester Univ., N. Y. Lab. for Laser Energetics.
RAMAN SCATTERING IN INHOMOGENEOUS LASER PRODUCED PLASMA
A. Simon, W. Seka, L. M. Goldman, and R. W. Short Sep. 1985 59 p
(Contract DE-FC08-85DP-40200)
(DE86-003782; DOE/DP-40200/T3) Avail: NTIS HC A04/MF A01

A model of Raman scattering in inhomogeneous laser produced plasma is described, which invokes enhanced Thomson scattering. The enhancement is due to pulses of hot electrons arising from laser-plasma interactions at the critical or quarter-critical surfaces. A simple model predicts the locations of two enhanced frequency bands, one between omega sub o and omega sub o/2, and the other between 2 omega sub o and omega sub o. The model is shown to fit the results of eight experiments, including a new experiment using the 6-beam Omega laser facility, converted to 351 nm. In this latter experiment, simultaneous measurement of the upscattered and downscattered bands is carried out, and good agreement is found with the enhanced Thomson model. DOE

N86-27994# Rochester Univ., N. Y. Lab. for Laser Energetics.
ENHANCED THOMSON SCATTERING THEORY APPLIED TO EIGHT EXPERIMENTS
A. Simon, R. W. Short, W. Seka, and L. M. Goldman 1985 15 p Presented at the 29th Annual Anomalous Absorption Conference, Banff, Alberta, 23 Jun. 1985
(Contract DE-FC08-85DP-40200)
(DE86-004927; DOE/DP-40200/17; CONF-8506221-4) Avail: NTIS HC A02/MF A01

The onset of an instability, such as the 2 omega (sub p) at the n(sub c)/4 surface, usually leads to wave breaking and the emission of hot electron pulses which can profoundly influence instability thresholds and scattering behavior elsewhere in the plasma. In particular, enhanced Thomson scattering (via the plasma line) can occur, and this has been used to explain the observation of the SRS instability well below the theoretical threshold. A simple model of the hot electron pulses based on measured values of the hot and cold electron temperatures T (sub h) and T(sub c), has yielded good agreement with experimental observation of the Raman spectral frequency bands. The agreement has continued, even for experiments which are clearly above the SRS threshold, with the enhanced noise likely acting as a seed for the SRS growth. We will show details of the successful comparison of this theory with six experiments carried out on SHIVA, ARGUS, NoVETTE(2), and GDL(2), and also with an upscattering feature seen at Garching. In addition, a recent experiment using 6 beams of OMEGA (at 0.35 microns) will be discussed, and compared with the theory. The report is comprised of viewgraphs of the talks. DOE

N86-27995 Texas Univ., Austin.
THE LINEAR INSTABILITY AND NONLINEAR MOTION OF ROTATING PLASMA Ph.D. Thesis
Jixing Liu 1985 212 p
Avail: Univ. Microfilms Order No. DA8529881

Two coupled nonlinear equations describing the flute dynamics of the magnetically confined low beta collisionless rotating plasma are derived. The linear instability and nonlinear dynamics of the rotating column are analyzed theoretically. From the exact solution of eigenvalue equation for Gaussian density profile and uniform rotation of the plasma, the stability of the system strongly depends on the direction of plasma rotation, FLR effect, and the location of the conduction wall. An analytic expression showing the finite wall effect on different normal modes is obtained. The sheared rotation drive instability is investigated by using three model equilibrium profiles and the analytic expressions of eigenvalues which includes the wall effect are obtained. The analogy between shear rotation driven instability and the instability driven by sheared plane parallel flow in the inviscid fluid is analyzed.
Dissert. Abstr.

N86-27337# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. di Fisica dello Spazio INterplanetario.
COLLISIONLESS SHOCK WAVES IN SPACE AND IN ASTROPHYSICS
V. Formisano *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 83-100 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27340# Saint Andrews Univ. (Scotland). Dept. of Applied Mathematics.
SMALL-SCALE RECONNECTION
E. R. Priest *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 137-149 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27344# Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.
CHARACTERISTIC PHENOMENA OF MAGNETOHYDRODYNAMIC TURBULENCE
D. Montgomery *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 175-179 (For primary document see N86-27330 18-12)
(Grant NAGw-719; Contract DE-FG02-85ER-53194)
Avail: NTIS HC A12/MF A01

76 SOLID-STATE PHYSICS

Includes superconductivity.
For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N86-27996*# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
CRYSTAL GROWTH OF DEVICE QUALITY GaAs IN SPACE Annual Report, 1 Apr. 1985 - 31 Mar. 1986
Harry C. Gatos and Jacek Lagowski 1986 36 p
(Grant NsG-7331)
(NASA-CR-177268; NAS 1.26:177268) Avail: NTIS HC A03/MF A01 CSCL 20L

It was established that the findings on elemental semiconductors Ge and Si regarding crystal growth, segregation, chemical composition, defect interactions, and materials properties-electronic properties relationships are not necessarily applicable to GaAs (and to other semiconductor compounds). In many instances totally unexpected relationships were found to prevail. It was further established that in compound semiconductors with a volatile constituent, control of stoichiometry is far more critical than any other crystal growth parameter. It was also shown that, due to suppression of nonstoichiometric fluctuations, the advantages of space for growth of semiconductor compounds extend far beyond those observed in elemental semiconductors. A novel configuration was discovered for partial confinement of GaAs melt in space which overcomes the two major problems associated with growth of semiconductors in total confinement. They are volume expansion during solidification and control of pressure of the volatile constituent. These problems are discussed in detail. E.R.

N86-27997# Electrotechnical Lab., Ibaraki (Japan).
A STUDY ON CARRIERS IN THE INSULATOR AND AT THE SEMICONDUCTOR-INSULATOR INTERFACE OF AN MIS STRUCTURE
Kiyoko Nagai Dec. 1985 51 p In JAPANESE; ENGLISH summary
(EL-860; ISSN-0366-9106; UDC-621.382) Avail: NTIS HC A04/MF A01

Effects of carriers in the metal-insulator-semicondustor (MIS) structure and on the electrical erasibility in the floating gate type nonvolatile memory are studied. Avalanche breakdown characteristics of an metal-oxide-semiconductor (MOS) diode driven by a linear ramp voltage are discussed. Avalanche breakdown characteristics between the channel and the substrate of an MOS field effect transistor (MOSFET) are discussed for efficient carrier injection. Carrier injection is shown by both theoretical analysis and measurement. Oxide trap and interface trap creation by injected carrier are examined. The effects of interface trapped charge on the static characteristics of the MOSFET are investigated. Also discussed are the theoretical effects of fixed oxide charge and interface trap charge on the low and high frequency capacitance-voltage curves of a semiconductor-insulator-semiconductor structure. Several types of EEPROM (electrically erasable read only memory) are proposed, two of which were fabricated to demonstrate the write and erase characteristics. Analog memory using the floating gate type EEPROM is discussed. B.G.

N86-27998# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.
OBSERVATION OF MECHANISM FOR HIGHER OPERATING TEMPERATURE EXTRINSIC DETECTORS Interim Report, Mar. 1981 - Aug. 1983
Gail J. Brown, Melvin C. Ohmer, David Fischer, Steve Smith, and Frank Szmulowicz May 1985 56 p

(AD-A165274; AFWAL-TR-85-4012) Avail: NTIS HC A04/MF A01 CSCL 17/8

Spectral photoconductivity, detectivity, infrared absorption and Hall effect transport measurements were used to study the electrical and optical properties of Si:In that had been irradiated with 1 MeV electrons. The Hall effect and infrared absorption measurements showed no unusual behavior before or after irradiation. The photoconductivity and detectivity measurements showed a large improvement in the operating temperature range of the Si:In material after electron irradiation. Before irradiation, the detector signal became swamped by noise at 22K. After irradiation, the signal was maintained up to 80K. The magnitude of the photoresponse versus temperature remained constant up to 65K at which temperature detector noise began to set in. A constant D* peak value of 2.2 x 10 to the 10th power (cm-sq rt. Hz/Watt) was measured up to 60K. GRA

N86-27999# Evans (Charles) and Associates, San Mateo, Calif.
THE DEVELOPMENT OF SPUTTERED NEUTRAL MASS SPECTROMETRY FOR THE QUANTITATIVE DEPTH PROFILING OF COMPOUND SEMICONDUCTOR MATERIALS Technical Progress Report, 1 Nov. - 15 Dec. 1985
David A. Reed 15 Dec. 1985 17 p
(Contracts N00014-85-C-0858; ARPA Order 4941)
(AD-A165516) Avail: NTIS HC A02/MF A01 CSCL 20/12

This report evaluates the applications potential of sputtered neutral mass spectrometry (SNMS) as implemented in the INA-3 for advanced materials characterization. The report will detail initial hands-on experiences with SNMS via the prototype version of the INA-3. The key functional components and parameters are: 1) The rf plasma uniquely established by pressure, rf power and external DC magnetic field, 2) Ion extraction optics consisting of an extraction electrode, focusing lens, 30 deg electrostatic analyzer (ESA) and transfer elements required to transport the energy filtered ion beam into a quadrupole mass spectrometer. 3) A conventional quadrupole mass filter with electron multiplier detector, and 4) The target bias supply. In the latter case, the Kaiserslautern instrument references the target potential to the plasma potential via a Langmuir probe, whereas the INA-3 presently references the target power supply to ground potential (i.e., no Langmuir probe). Studies to date have indicated that a Langmuir reference might make a significant improvement. GRA

N86-28000# Department of the Navy, Washington, D. C.
PREPARATION OF REFRACTORY TUNNEL BARRIERS OF SPUTTERED BORON NITRIDE Patent Application
Randy W. Simon, Kenneth E. Kihlstrom, and John H. Claassen, inventors (to Navy) Filed 23 Dec. 1985 10 p
(AD-D012184; US-Patent-Appl-SN-811974) Avail: NTIS HC A02/MF A01 CSCL 20/12

The present invention relates to Josephson Junctions. More specifically the present invention relates to high quality artificial tunnel barriers found in a Josephson junction. A Josephson Junction is a weak connection between two superconducting layers through which the Josephson effect is realized. The Josephson effect is where the passage of paired electrons (Cooper pairs) through a weak connection forms a current (supercurrent) in addition to the usual current that results from the passage or tunneling of single electrons. Objects of the present invention are to provide a tunnel barrier that has a sharp even interface with the superconducting metal; to provide a tunnel barrier that is amorphous; and to provide a tunnel barrier that does not breakdown under high temperature conditions. These, and other objects of the present invention are achieved with a Josephson junction comprising: a first superconducting layer; a second superconducting layer; and a tunnel barrier of boron nitride located between the first and second superconducting layers and in contact therewith. GRA

N86-27484# Joint Publications Research Service, Arlington, Va.
CRYOGENICS OF CHINA'S NIOBIUM MATERIAL (Nb2-1)
Jiasu Wang and Suyu Wang *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 72-74 Transl. into ENGLISH from Dianzi Xuebao (Acta Electronica Sinica) (Beijing, China), v. 13, no. 5, Sep. 1985 p 119-120 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

N86-27499# Joint Publications Research Service, Arlington, Va.
CZOCHRALSKI GROWTH OF TUNABLE LASER CRYSTAL BeAl(SUB)2O(SUB)4:Cr(SUP)3+
Xiaoshan Ma, Yinchun Hou, Siting Wang, Yafang Shen, and Zongru Jin *In its* China Report: Science and Technology (JPRS-CST-86-008) 1 Mar. 1986 p 186-193 Transl. into ENGLISH from Guisuanyan Xuebao (Beijing, China), v. 12, no. 2, Jun. 1984 p 131-136 (For primary document see N86-27482 18-31)
Avail: NTIS HC A11/MF A01

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N86-28001# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
ANOMALIES AND TOPOLOGY
R. Jackiw Aug. 1985 24 p Proceedings of Theoretical Advanced Study Inst. in Elementary Particle Physics, New Haven, Conn., Jun. - Jul. 1985 Submitted for publication
(Contract DE-AC02-76ER-03069)
(DE86-000569; DOE/ER-03069/T5) Avail: NTIS HC A02/MF A01

The lectures given cover the topological effects in gauge field theories, fermionic chiral anomalies, and some relationships between the two. Gauge field theories in three and four space-time dimensions are considered. Topological terms as external U(1) functional gauge potential connections in field space are discussed. Both the structure and physical impact of anomalies are described. DOE

N86-28002# California Univ., Berkeley. Dept. of Chemical Engineering.
CONTINUOUS THERMODYNAMICS FOR PHASE EQUILIBRIA AND ENTHAIPY CALCULATIONS Annual Report, Sep. - 1984 - Aug. 1985
G. F. Chou, R. L. Cotterman, and J. M. jPrausnitz Oct. 1985 32 p
(Contract GRI-5083-260-0953)
(PB86-178985; GRI-85/0242) Avail: NTIS HC A03/MF A01 CSCL 20M

A numerical procedure has been developed for performing adiabatic flash calculations for continuous and semicontinuous mixtures using the Soave equation of state; the procedure uses Gaussian quadrature method to solve phase-equilibrium and enthalpy equations containing integrals of continuous distribution functions. To perform adiabatic flash calculations within continuous-thermodynamic framework, equation-of-state parameters and ideal-gas heat capacities are correlated with molecular weight for hydrocarbon homologous series. The flash-calculation results compare favorably to those obtained using the discrete method; continuous thermodynamics give better results than does the pseudocomponent method and the difference in results depends on the arbitrary selection of Pseudocomponents. Author (GRA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N86-28003*# National Academy of Sciences - National Research Council, Washington, D. C. Office of Scientific and Engineering Personnel.

POSTDOCTORAL AND SENIOR POSTDOCTORAL RESIDENT RESEARCH ASSOCIATESHIP PROGRAM AND RESEARCH MANAGEMENT ASSOCIATESHIP PROGRAM FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Status Report, 1 Mar. - 31 May 1986
1986 137 p
(Contract NASw-3458)
(NASA-CR-177203; NAS 1.26:177203; SR-87) Avail: NTIS HC A07/MF A01 CSCL 05I

Information on the status of all Resident Research Associated and Research Management Associates is provided. All Associated whose tenure continued as of June 1, 1985 are listed alphabetically by laboratory. Also included are their countries of citizenship and dates of tenure. The status of reporting obligations are summarized. A list of progress reports received during this reporting period is also provided. All Associates who terminated during the reporting period are listed. B.G.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N86-28004*# Texas A&M Univ., College Station. Industrial Engineering Div.
CREATION OF THE SELECTION LIST FOR THE EXPERIMENT SCHEDULING PROGRAM (ESP) Final Report
Bryan L. Deuermeyer, Robert E. Shannon, and Alvin J. Underbrink, Jr. 15 May 1986 74 p
(Contract NAS8-35972)
(NASA-CR-178861; NAS 1.26:178861) Avail: NTIS HC A04/MF A01 CSCL 05A

The efforts to develop a procedure to construct selection groups to augment the Experiment Scheduling Program (ESP) are summarized. Included is a User's Guide and a sample scenario to guide in the use of the software system that implements the developed procedures. Author

N86-28005# Naval Postgraduate School, Monterey, Calif.
TECHNICAL DATA PACKAGE: A SECOND SOURCING METHODOLOGY M.S. Thesis
Robert E. Hale Dec. 1985 138 p
(AD-A165028) Avail: NTIS HC A07/MF A01 CSCL 15/5

The purpose of this thesis was to analyze the Technical Data Package as a second sourcing methodology to create production competition. Two second sourcing models and two major weapon system programs were presented for this analysis. Issues analyzed include technology transfer, Technical Data Package validation, technical data rights, initial investment costs, and maintenance considerations. As a results of this analysis it is concluded that there is no significant guidance for the application of the Technical Data Package second sourcing methodology, there are circumstances that are particularly inappropriate for the use of this methodology, and that the two programs that used this methodology appeared to have met their acquisition goals. This study recommends that one second sourcing model be employed under actual program conditions and that the program manager perform a comprehensive data package validation prior to using this second sourcing methodology. GRA

N86-28006# Department of the Air Force, Andrews AFB, Md. Directorate of Cost and Management Analysis.
EXAMINING THE AFSC (AIR FORCE SYSTEMS COMMAND) PRODUCTION RATE MODEL
Thurman D. Gardner 20 Sep. 1985 19 p Presented at the Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A165033) Avail: NTIS HC A02/MF A01 CSCL 13/8

A problem facing the cost estimator and the program manager is the need to assess program cost impacts resulting from changes in production rate. The Air Force Systems Command (AFSC) has developed the Production Rate Model for providing quick same day responses. The model is based on the assumption that the influence an increasing production rate has on decreasing the unit cost is limited. This idea follows the minimum cost point found on the long run average cost curve in economic theory. In the model's case the point is determined by the manufacturer prior to production. This point is based on plant capacity, capital investment and manpower requirements, anticipated quantities and production rate, and requirements specified by the government. The AFSC model modifies the learning curve equation by including a variable representing production rate. This equation is used to estimate recurring cost. There is an internal data base of historical programs containing first unit cost, learning curve slope, and production rate slope generated with a nonlinear regression technique. The nonlinear regression technique was used to reduce the effects of multicollinearity and bias associated with ordinary least squares regression. AFSC knows about and accepts the statistical limitation because the model was developed to provide a good approximation of the change in cost that result from a production rate change. GRA

N86-28007# National Oceanic and Atmospheric Administration, Washington, D. C.
OPTIMUM MANAGEMENT STRATEGIES FOR THE NOAA (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION) POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITES, 1985-2000. VOLUME 1 Final Report
W. H. Eskite and W. P. Bishop Apr. 1985 70 p
(AD-A165143) Avail: NTIS HC A04/MF A01 CSCL 05/1

The experience of the past 15 years was used as a basis to establish the best management principles to apply to the POES for the next 15 years. This was done for both a two-satellite configuration and a one-satellite configuration. The principles include always having a spare available, a 4-month call-up capability, taking advantage of satellites that live longer than their design life, and taking advantage of early indications of imminent failure. These principles must be applied in different ways to the two configurations. Applying these principles to several scenarios for the future leads to the conclusion that we should plan for 12 satellites for the next 15 years for either the one-satellite or the two-satellite system. Author (GRA)

N86-28008# Naval Postgraduate School, Monterey, Calif.
AN ASSESSMENT OF THE LIFE CYCLE CONTRACTING MODEL FOR USE BY MAJOR AEROSPACE WEAPON SYSTEM ACQUISITION MANAGERS M.S. Thesis
Kimberly J. Annunziata Dec. 1985 144 p
(AD-A165238) Avail: NTIS HC A07/MF A01 CSCL 15/5

The utility of using the Life Cycle Contracting Model in major weapon systems acquisition is assessed. The conclusions are based on an analysis of LCC model simulated real world follow-on production contracting scenarios. What if changes are made to the contracting scenario parameters to understand how the LCC model might be used by major weapon system acquisition and contract managers. An analysis shows that the LCC model can be used to interpret the results of trade-off decisions and to assist the contract manager in developing sound negotiating strategy alternatives. Total contract cost to the government cannot be predicted with the model but the effects on total cost of decisions made can be inferred and compared. The LCC model should be used to justify deviations from full and open competition and to demonstrate the predicted results of viable, lower cost alternatives to firm fixed price contracting. GRA

N86-28009# Naval Postgraduate School, Monterey, Calif.
COST INFORMATION REQUIREMENTS FOR MANAGING AIRCRAFT REWORK M.S. Thesis
David P. Faust and John W. Highsmith Dec. 1985 56 p
(AD-A165262) Avail: NTIS HC A04/MF A01 CSCL 05/1

Managing the diverse aspects of a Naval Air Rework Facility (NARF) is a complex and demanding task. This thesis provides fresh input into two of the areas that are of concern to NARF management on a daily basis. First is the management of cost data to provide meaningful information for managers at all levels of the organization. Included is a brief explanation of the economic rationalization that supports the Life Cycle Cost concept. A discussion of the types of financial information needed by managers and deficiencies in the NIF accounting system follows. The next section centers on the basis behind the Reliability Centered Maintenance concept and how the deficiencies in the information collection system at NARF Alameda fail to support the demands of this concept. Recommendations are provided to alleviate both short and long run deficiencies. GRA

N86-28010# Naval Postgraduate School, Monterey, Calif.
GOVERNMENT MANAGEMENT OF CONTRACTOR SUBMISSION OF VALUE ENGINEERING CHANGE PROPOSALS M.S. Thesis
Gary G. Given Dec. 1985 65 p
(AD-A165271) Avail: NTIS HC A04/MF A01 CSCL 05/1

The purpose of this thesis is to determine how the Department of Defense value engineering policies and processing procedures affect a contractor's motivation to submit value engineering change proposals. A comparative analysis of the DOD Value Engineering Program with private industry's value analysis program and also an examination of how the Hughes Aircraft Company has used the DOD Value Engineering Program, resulted in three conclusions. The first conclusion is that the incentives offered by the DOD Value Engineering Program have been found by private industry to be ineffective in attracting supplier participation in value analysis. The second conclusion is that delays in incorporating the VECP in the end-item significantly reduces a contractor's motivation to submit future VECPs. The third conclusion is that the contractor's perception of the government buying activity's willingness to fairly evaluate VECPS is the most significant influence on a contractor's motivation to submit VECPs. Author (GRA)

N86-28011# Naval Postgraduate School, Monterey, Calif.
CONTROLLING LIFE-CYCLE COST: A MANAGEMENT PERSPECTIVE M.S. Thesis
David L. Porter Dec. 1985 148 p
(AD-A165520) Avail: NTIS HC A07/MF A01 CSCL 05/1

The objective of this thesis is to examine the obstacles which are preventing the Navy from realizing the full economic advantage of a total cost management program for aviation support equipment. The research has shown that Navy program managers are not fully committed to managing life-cycle cost nor is it considered early enough in the procurement process to influence design. To improve the life-cycle cost management effort, existing policies and provisions included in DoD Directives should be applied to aviation support equipment. More emphasis should be placed on the RFP as a means of communicating the Navy's concerns about controlling cost and adequate information should be provided to the contractor to be used in developing realistic cost estimates. Finally, life-cycle cost should be elevated to the level of unit-production cost, schedule and performance and made a mandatory source selection criterion. GRA

N86-28012# Department of Energy, Washington, D. C. Office of Civilian Radioactive Waste Management.
PROGRAM MANAGEMENT SYSTEM MANUAL
Jan. 1986 95 p
(DE86-005396; DOE/RW-0043) Avail: NTIS HC A05/MF A01

The Program Management System (PMS), as detailed in this manual, consists of all the plans, policies, procedure, systems, and processes that, taken together, serve as a mechanism for managing the various subprograms and program elements in a cohesive, cost effective manner. The PMS is consistent with the requirements of the Nuclear Waste Policy Act of 1982 and the Mission Plan for the Civilian Radioactive Waste Management Program (DOE/RW-0005). It is based on, but goes beyond, the DOE management policies and procedures applicable to all DOE programs by adapting these directives to the specific needs of the Civilian Radioactive Waste Management program. This PMS Manual describes the hierarchy of plans required to develop and maintain the cost, schedule, and technical baselines at the various organizational levels of the Civilian Radioactive Management Program. It also established the management policies and procedures used in the implementation of the program. These include requirements for internal reports, data, and other information; systems engineering management; regulatory compliance; safety; quality assurance; and institutional affairs. Although expanded versions of many of these plans, policies, and procedures are found in separate documents, they are an integral part of this manual. The PMS provides the basis for the effective management that is needed to ensure that the Civilian Radioactive Waste Management Program fulfills the mandate of the Nuclear Waste Policy Act of 1982. DOE

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N86-28013# Naval Postgraduate School, Monterey, Calif.
A RELATIONAL DATA DICTIONARY COMPATIBLE WITH THE NATIONAL BUREAU OF STANDARDS INFORMATION RESOURCE DICTIONARY SYSTEM M.S. Thesis
Robert A. Kirsch, II Dec. 1985 254 p
(AD-A165022) Avail: NTIS HC A12/MF A01 CSCL 05/2

Data is a very valuable corporate asset. How it is managed and controlled can often determine the success or failure of a corporate venture. With this fact in mind many organizations are taking a close look at what tools are available to help them in this effort. This thesis takes a look at two types of data management tools available today, the Relational Data Base Base Management System (DBMS) and the Data Dictionary (DD). It discusses desirable DBMS and DD characteristics with particular attention being paid to the shortcomings of DDs. It also describes the effort of the National Bureau of Standards (NBS) to develop a DD standard and examines in detail the NBS Information Resource Dictionary System (IRDS) and how the standard was implemented in a prototype IRDS. Author (GRA)

N86-28014# Department of Defense, Washington, D. C. Directorate for Information Operations and Repts.
LIST OF APPROVED RECURRING INFORMATION REQUIREMENTS. VOLUME 1
31 Jan. 1986 90 p
(AD-A165078; DIOR/DOD-5000.19-L-Vol-1; DOD-5000.19-L-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 05/1

The purpose of the volume is to identify DOD internal information requirements approved by OSD, interagency reporting requirements approved by the General Services Administration, and DOD public-use reports approved by the Office of Management and Budget (OMB). GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N86-28015# General Accounting Office, Washington, D. C. National Security and International Affairs Div.
PROCUREMENT: AN ASSESSMENT OF THE AIR FORCE'S F-16 AIRCRAFT MULTIYEAR CONTRACT
Feb. 1986 26 p
(PB86-168026; GAO/NSIAD-86-38; B-215825; AD-A165720) Avail: NTIS HC A03/MF A01 CSCL 15E

The authors reviewed the Air Force's F-16 multiyear contract

for fiscal years 1982 to 1985. They assessed potential savings from using a multiyear contract instead of a series of annual contracts, the effect of foreign military sales on multiyear contract prices, the effect of aircraft the Congress added to the fiscal year 1984 budget on multiyear contract prices, and other benefits of using multiyear contracting. The substance of the report was provided in a briefing on the preliminary findings of the review.
GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N86-28016# National Oceanic and Atmospheric Administration, Washington, D. C.
INTERNATIONAL COORDINATION OF AND CONTRIBUTIONS TO ENVIRONMENTAL SATELLITE PROGRAMS Final Report
P. Uhlir and L. Shaffer Jun. 1985 65 p
(AD-A165142) Avail: NTIS HC A04/MF A01 CSCL 22/2

The paper begins with an overview of U.S. policy on remote sensing. Next, the extensive international cooperation in U.S. Polar-orbiting Operational Environmental Satellites (POES) is described. This includes participation in the POES direct readout services program, and existing instrument contributions and commitments to the POES system. The opportunities and mechanisms for future contributions to POES, or to the polar platform component of the U.S. Space Station, are also examined. Geostationary environmental satellites are operated by the United States, the European Space Agency, Japan, and India. These systems are described, and the Coordination on Geostationary Meteorological Satellites is discussed. Other international organizations used for cooperation and coordination in remote-sensing activities are outlined. These include the World Meteorological Organization, the Intergovernmental Oceanographic Commission, the International Council of Scientific Unions, and the Committee on Earth Observations Satellites. Contributions by the United States to planned foreign remote-sensing programs are addressed as well. Finally, the report identifies and discusses three trends in remote sensing, and makes some concluding observations about the future of international remote-sensing ac tivities. Appendix A lists the dates of all relevant documents, such as Memoranda of Understanding, Terms of Reference for international committees, and Minutes of Meetings.
GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N86-28017*# Mechanical Technology, Inc., Latham, N. Y.
AUTOMOTIVE STIRLING ENGINE DEVELOPMENT PROGRAM Semiannual Technical Progress Report, 1 Jan. - 30 Jun. 1984
N. Nightingale, A. Richey, R. Farrell, G. Riecke, W. Ernst, R. Howarth, M. Cronin, M. Simetkosky, and G. Smith Dec. 1984 103 p
(Contracts DEN3-32; DE-AI01-77CS-51040)
(NASA-CR-174749; DOE/NASA/0032-80/7; NAS 1.26:174749) Avail: NTIS HC A06/MF A01 CSCL 13F

This is the sixth Semiannual Progress Report prepared under the Automative Stirling Engine Development Program. It covers the twenty-fourth and twenty-fifth quarters of activity after award of the contract. Quarterly Technical Progress Reports related program activities from the first through the thirteenth quarters; thereafter, reporting was changed to a semiannual format. This report summarizes activities performed on Mod I engine characterization and analyses, Mod I Transient Test Bed fuel economy, upgraded Mod I performance and testing, Stirling engine reference engine manufacturing and reduced size studies, components and subsystems, and the study and test of low cost casting alloys. The overall program philosophy is outlined, and data and results are presented.
Author

N86-28018# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
THE COORDINATION OF COMMUNITY TRANSPORT RESOURCES: A CASE STUDY OF SHARED TRANSPORT SERVICE, BIRMINGHAM
A. Warrington 1986 114 p
(TT-8603) Avail: NTIS HC A06/MF A01

The last decade has been characterized by a substantial growth in the number of community organizations purchasing minibuses in attempts to meet their specific clients' mobility needs. Recently these groups have been faced with severe economic constraints, with many government grants being cut back. The overarching aim of the project was to examine the management and coordination of community transport from the perspective of participants in such schemes, with particular reference to their views about is applicability. One of the objectives set to meet this aim involved undertaking three case studies of co-ordinated transport schemes in Britain. The information presented in this work is from one of the three individual case studies undertaken. The findings are presented from the case study of Shared Transport Service (STS), the community transport co-ordination scheme in Birmingham. The planning of the STS brokeage scheme is dicussed. An appraisal of the day to day operation of STS is given. The barriers to and problems of vehicle sharing are discussed. Finally, an evaluation of the STS project and benefits arising from the use of the brokeage service is presented. presented.
B.W.

88 SPACE SCIENCES (GENERAL)

N86-28019*# Lunar and Planetary Inst., Houston, Tex.
WORKSHOP ON PAST AND PRESENT SOLAR RADIATION: THE RECORD IN METEORITIC AND LUNAR REGOLITH MATERIAL
R. O. Pepin, comp. and D. S. McKay, comp. 1986 41 p Workshop held in Mainz, West Germany, 3-4 Sep. 1983
(Contract NASw-4066)
(NASA-CR-177305; NAS 1.26:177305; LPI-TR-86-02) Avail: NTIS HC A03/MF A01 CSCL 03B

The principal question addressed in the workshop was the extent to which asteroidal and lunar regoliths have collected and preserved, in meteoritic regolith breccias and in lunar soils and regolith breccias, a record of the flux, energy, and compositional history of the solar wind and solar flares. Six central discussion topics were identified. They are: (1)Trapped solar wind and flare gases, tracks, and micrometeorite pits in regolith components; (2)Comparison between lunar regolith breccias, meteoritic regolith breccias, and the lunar soil; (3)The special role of regolith breccias and the challenge of dating their times of compaction; (4)Implications of the data for the flux and compositional history of solar particle emission, composition, and physical mechanisms in the solar source regions, and the composition of the early nebula; (5)How and to what extent have records of incident radiation been altered in various types of grains; (6)Future research directions For individual titles, see N86-28020 through N86-28035.

N86-28020*# California Univ., San Diego. Dept. of Chemistry.
SOLAR PARTICLE HISTORY: 1983 VERSION **c92**
J. R. Arnold, R. C. Reedy (Los Alamos National Lab., N. Mex.), and K. Nishiizumi *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 11 (For primary document see N86-28019

18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

It has long been known that the great majority of nuclear active solar particles are emitted in a few large storms in each 11 year cycle. A single storm in August 1972 dominated the fluence of particles of energy >10 MeV. Such storms can occur, it seems, at any time within the more active half ot the cycle. On a time scale long compared to 11 years, the knowledge comes from two sources. Terrestrial C-14 sets limits on the largest proton bursts that can have taken place in the 8000 years. Lunar surface samples have yielded data on mean fluxes on a time scale from the C-14 to the Mn-53 mean life. A mean flux was found of 70 protons >10 MeV and a rigidity constant R sub o = 100 MV to be robust on the 1,000,000 to 10,000,000 year time scale. Over the shorter periods represented by C-14 and Kr-81 the fluxes seem to have been higher by a factor of roughly three. Some examples of dating are discussed. Author

N86-28021*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
SOLAR WIND HELIUM, NEON AND ARGON RELEASED BY OXIDATION OF METAL GRAINS FROM THE WESTON CHONDRITE c92
R. H. Becker, R. S. Rajan (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), and E. R. Rambaldi *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 12-13 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

A set of experiments were carried out to test the feasibility of determining unfractionated elemental and isotopic ratios for the noble gases in the presumably ancient solar wind present in the gas rich meteorites. The problems of diffusive loss was avoided by analyzing metal rather than the usual silicates. In order to avoid chemical, and even harsh physical, treatment of the sample, which might have affected the surfaces of metal grains, a means of analyzing the metal in the presence of residual silicate not removed by gentle crushing and magnetic separation was devised. Preliminary results given were obtained by taking advantage of the differing properties of metal and silicates with regard to diffusion. The results suggests that, with some modifications in the choice of pyrolysis and combustion temperatures and in the amount of O2 used, it should be possible, by oxidizing the surfaces of metal grains from gas rich meteorites, to obtain data on solar wind that has not been fractionated by diffusive loss. E.R.

N86-28022*# Houston Univ., Clear Lake, Tex.
PARTICLE TRACK MEASUREMENTS IN LUNAR REGOLITH BRECCIAS c91
George E. Blanford *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 14-16 Previously announced as A85-17791 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

Particle track measurements have been reported for 25 (5 percent) of the regolith breccias in the collection; they have been reported for 16 breccias (30%) in the reference suite. The most frequently reported measurement for these 25 breccias is the maximum surface exposure age of the compacted rock (48% of the published breccia measurements). Information on the nature of the precompaction regolith is given for 9 rocks (36%) and on the nature of the compaction event for 6 rocks (24%). Most of the breccias appear to have simple post compaction surface exposure histories (89%). From the few track density frequency distributions (7) that are available and inferring from the low exposure ages of these rocks (75% were younger than 10 to the 6th years), it appears that most of these breccias are amenable to studies which separate the contemporary surface exposure age from information about the precompaction regolith. If the number of immature submature precompaction soils (6 out of 10 of the breccias for which appropriate data are available) represents many regolith breccias, then it is inferred that regolith breccias may sample the deeper, less reworked materials in the lunar soil and compliment the samples available from the returned cores. Author

N86-28023*# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
SCR AND GCR EXPOSURE AGES OF PLAGIOCLASE GRAINS FROM LUNAR SOIL c91
Ph. Etique, H. Baur, P. Signer, and R. Wieler *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 18-19 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

The concentrations of solar wind implanted Ar-36 in mineral grains extracted from lunar soils show that they were exposed to the solar wind on the lunar surface for an integrated time of 10E4 to 10E5 years. From the bulk soil 61501 plagioclase separates of 8 grain size ranges was prepared. The depletion of the implanted gases was achieved by etching aliquot samples of 4 grain sizes to various degrees. The experimental results pertinent to the present discussion are: The spallogenic Ne is, as in most plagioclases from lunar soils, affected by diffusive losses and of no use. The Ar-36 of solar wind origin amounts to (2030 + or - 100) x 10E-8 ccSTP/g in the 150 to 200 mm size fraction and shows that these grains were exposed to the solar wind for at least 10,000 years. The Ne-21/Ne-22 ratio of the spallogenic Ne is 0.75 + or - 0.01 and in very good agreement with the value of this ratio in a plagioclase separate from rock 76535. This rock has had a simple exposure history and its plagioclases have a chemical composition quite similar to those studied. In addition to the noble gases, the heavy particle tracks in an aliquot of the 150 to 200 mm plagioclase separate were investigated and found 92% of the grains to contain more than 10E8 tracks/sq cm. This corresponds to a mean track density of (5 + or - 1) x 10E8 tracks/sq cm. The exploration of the exposure history of the plagioclase separates from the soil 61501 do not contradict the model for the regolith dynamics but also fail to prove it. Author

N86-28024*# Bern Univ. (Switzerland). Physikalisches Inst.
THE COMPOSITION OF LUNAR NOBLE GASES TRAPED 2.5 AE AND 3.5 AE AGO c91
O. Eugster *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Materials 1986 p 20 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

The times when the soils 74001 and 73261 were exposed on the lunar surface were determined by the U-235 - Xe-136 dating method. The isotopic composition of the trapped noble gases in these two soils is compared with that of the surface correlated noble gases in the young soils 12001 and in the present day solar wind. The surface correlated trapped gases are a mixture of implanted solar wind particles and retrapped lunar atmospheric gases. The observed changes are interpreted as a result of decreasing outgassing of radiogenic Ar-40 and perhaps He-4 and of fissiogenic Xe from the lunar crust. The old soils probably also contain surface correlated Kr-80 and Kr-82 produced by secondary cosmic ray neutron capture of adsorbed or retrapped bromine. To some extent the isotopic composition of the trapped gases in old lunar soil may also have been altered due to diffusion loss from material of low retentivity. Author

N86-28025*# Bern Univ. (Switzerland). Physikalisches Inst.
THE DATING OF PRE-EXPOSURE TIMES OF LUNAR ROCKS AND SOILS c91
O. Eugster *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 21 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

Xenon produced by fission of uranium, thorium and plutonium has repeatedly been observed in lunar rocks and soils. In two basaltic rocks and in two soils Xe was found originating from fission of U-235 induced by neutrons which are due to the

interactions of cosmic ray particles with lunar matter. Two facts lead to this conclusion: (1) fission Xe is present in excess of that expected for the U, Th, and Pu concentrations and for the gas retention age of the samples; and (2) the Xe-134/Xe-136 ratio of excess fission Xe is close to 1.25 as expected for neutron induced fission of U-235. Information on the duration of the exposure to cosmic rays was obtained from the Kr-81-Kr systematics whereas the effective shielding conditions were derived from the depth sensitive cosmogenic ratio Xe-131/Xe-126. For the four samples the exposure to cosmic rays in the lunar regolith is described by a two stage exposure model. The history of the four samples was derived in terms of duration and shielding depth of the two stages. Author

N86-28026*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.

RELEASE OF NOBLE GASES AND NITROGEN FROM GRAIN-SURFACE SITES IN LUNAR ILMENITE BY CLOSED-SYSTEM OXIDATION **c91**

Urs Frick, Richard H. Becker, and R. O. Pepin *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 22-23 (For primary document see N86-28019 18-88)

Avail: NTIS HC A03/MF A01 CSCL 03B

Noble gases and nitrogen were extracted from a 100 to 150 microns ilmenite separate from lunar soil 71501 by closed system stepped heating in approx. 10 torr O2 at 300 C, 400 C, 500 C, 600 C and 630 C, followed by stepped pyrolysis at ten temperatures between 680 C and approx. 1500 C. The five oxidation steps together liberated approx. 65% of the total He-4, 45% of the Ne-20, 23% of the N-14 and Ar-36, 12% of the Kr-84 and 8% of the Xe-132 in the sample; Ne-20/Ar-36 and Ne-20/Ne-22 ratios agree with the solar wind composition experiment, and Kr-84/Ar-36 and Xe-132/Ar-36 are within approx. 10% of Cameron's estimates for the sun and solar wind. The remaining gases, released above 630 C by pyrolysis, are strongly fractionated with respect to the SWC-Cameron solar wind elemental composition. Large concentrations of fractionated noble gases in grain interiors, their virtual absence in the relatively unfractionated surface gas reservoir, and the high N/noble gas ratio all imply that most of the solar wind noble gases initially implanted in grain surfaces are eventually lost by diffusion. Loss limits can be estimated by considering two given scenarios. It is concluded tat approx. 70 to 97% or more of the Ar implanted in 71501 ilmenite grains has diffusively escaped. Author

N86-28027*# Washington Univ., St. Louis, Mo. Center for the Space Sciences.

BOUNDARY CONDITIONS ON THE EARLY SUN FROM ANCIENT COSMOGENIC NEON IN METEORITES **c92**

C. M. Hohenberg, M. W. Caffee, T. D Swindle, and J. Goswami (Physical Research Lab., Ahmedabad (India).) *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 24 (For primary document see N86-28019 18-88)

Avail: NTIS HC A03/MF A01 CSCL 03B

Isotopic analysis of neon from individual grains of the meteorites Murchison (CM) and Kapoeta (howardite) shows large enrichments of cosmogenic neon in grains with solar flare tracks. The quantity of this component is incompatible with galactic cosmic ray or solar cosmic ray irradiation under present conditions and is attributed to irradiation by energetic flares from an early active Sun. Handpicked grains from each meteorite were grouped according to the presence or absence of solar flare heavy ion tracks, and these four samples were analyzed with an ion counting noble gas mass spectrometer. Author

N86-28028*# California Univ., Los Angeles. Inst. of Geophysics.

THE REALITY OF THE SECULAR CHANGE IN SOLAR WIND NITROGEN ISOTOPES **c92**

J. F. Kerridge *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 25 (For primary document see N86-28019 18-88)

Avail: NTIS HC A03/MF A01 CSCL 03B

Evidence concerning the isotopic composition of N in the early solar system currently seems to favor a picture of isotopic inhomogeneity rather than of a unique primordial composition modified by local processes. Certainly the range of N-15/N-14 ratios found in meteorites points to the existence of more than one nucleogenetic N component, though mass dependent modification of them explain the isotopic variation observed for N in the lunar regolith. The observational evidence is addressed which can be used to discriminate between such a model and one invoking a secular change in the composition of the solar wind. Three tests of this model were considered, starting with a search for light planetary N surviving in lunar rocks. Results so far are negative. The results of these tests may not eliminate the two component model for regolith N but they seriously weaken it. The alternate view, involving a secular change in solar wind N composition, has its problems but continues to survive by default. Author

N86-28029*# Max-Planck-Inst. fuer Kernphysik, Heidelberg (West Germany).

DISTRIBUTION OF SOLAR WIND IMPLANTED NOBLE GASES IN LUNAR SAMPLES **c92**

J. Kiko and T. Kirsten *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 26-27 (For primary document see N86-28019 18-88)

Avail: NTIS HC A03/MF A01 CSCL 03B

The distribution of solar wind implanted noble gases in lunar samples depends on implantation energy, fluence, diffusion, radiation damage and erosion. It is known that at least the lighter rare gases are fractionated after implantation, but the redistribution processes, which mainly drive the losses, are not well understood. Some information about this one can get by looking at the concentration profiles of solar wind implanted He-4 measured by the Gas Ion Probe in single lunar grains. The observed profiles were divided in three groups. These groups are illustrated and briefly discussed. Author

N86-28030*# Missouri Univ., Rolla. Dept. of Chemistry.

THE NEED FOR ISOTOPIC DATA ON REFRACTORY ELEMENTS IN THE SOLAR WIND **c92**

O. K. Manuel *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 28 (For primary document see N86-28019 18-88)

Avail: NTIS HC A03/MF A01 CSCL 03B

The Sun accounts for the bulk of material in the solar system. Information on the isotopic composition of elements in the solar wind is therefore essential for an understanding of the contribution made by each nucleogenetic component that has been identified in meteorites. Recent work suggests that isotopic data on the solar wind may also help us to understand the physical process that is concentrating light elements at the solar surface. Refractory and volatile elements would behave alike under the conditions of solar fractionation. Prolonged exposure of foils at 1AU from the sun would be a relatively inexpensively way to collect the quantity of solar wind implanted refractory elements needed to test this hypothesis. Author

N86-28031*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PETROGRAPHIC SURVEY OF LUNAR REGOLITH BRECCIAS **c91**

D. S. McKay and Sue Wentworth (Lockheed Electronics Co., Houston, Tex.) *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 29-30 (For primary document see N86-28019 18-88)

Avail: NTIS HC A03/MF A01 CSCL 03B

Regolith breccias from the Moon and from parent bodies of some meteorites may provide samples of ancient regoliths which

have been frozen in time. If these rocks were essentially closed at some earlier time and that time can be determined, then these rocks provide a record of conditions in the solar system at that point in time. A survey of regolith breccias in the Apollo collection was conducted concentrating initially on Apollo 15 and 16. All available thin sections for 32 regolith breccias from Apollo 15 and 19 breccias from Apollo 16 were surveyed. These are most of the returned regolith breccias larger than 1 cm from these two mission. For comparison several fragmental matrix breccias which do not strictly qualify as regolith breccias were investigated. The criteria for classification as a regolith breccia is the presence of identifiable soil components such as glass spheres or agglutinates. The breccias are classified according to their intergranular porosity. In addition the fracture porosity is noted, and the relative abundance of agglutinates and spheres. Several petrographic trends are also noted. Identifiable regolith material decreases with decreasing intergranular porosity while fracture porosity increases. This relative lack of maturity of regolith breccias mayreflect their generally earlier formation age an the maturity of the regolith at that earlier time.
Author

N86-28032*# Physical Research Lab., Ahmedabad (India).
SOLAR FLARE NEON AND SOLAR COSMIC RAY FLUXES IN THE PAST USING GAS-RICH METEORITES **c92**
C. M. Nautiyal and M. N. Rao *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 31 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

Methods were developed earlier to deduce the composition of solar flare neon and to determine the solar cosmic ray proton fluxes in the past using etched lunar samples and at present, these techniques are extended to gas rich meteorites. By considering high temperature Ne data points for Pantar, Fayetteville and other gas rich meteorites and by applying the three component Ne-decomposition methods, the solar cosmic ray and galactic cosmic ray produced spallation Ne components from the trapped SF-Ne was resolved. Using appropiate SCR and GCR production rates, in the case of Pantar, for example, a GCR exposure age of 2 m.y. was estimated for Pantar-Dark while Pantar-Light yielded a GCR age of approx. 3 m.y. However the SCR exposure age of Pantar-Dark is two orders of magnitude higher than the average surface exposure ages of lunar soils. The possibility of higher proton fluxes in the past is discussed.
Author

N86-28033*# Cambridge Univ. (England).
LUNAR NITROGEN: SECULAR VARIATION OR MIXING? **c91**
S. J. Norris, I. P. Wright, and C. T. Pillinger *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 32-33 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

The two current models to explain the nearly 40% variation of the lunar nitrogen isotopic composition are: (1) secular variation of solar wind nitrogen; and (2) a two component mixing model having a constant, heavy solar wind admixed with varying amounts of indigenous light lunar N (LLN). Both models are needed to explain the step pyrolysis extraction profile. The secular variation model proposes that the low temperature release is modern day solar wind implanted into grain surfaces, the 900 C to 1100 C release is from grain surfaces which were once exposed to the ancient solar wind but which are now trapped inside agglutinates, and the >1100 C release as spallogenic N produced by cosmic rays. The mixing model ascribes the components to solar wind, indigenous lunar N and spallogenic N respectively. An extension of either interpretation is that the light N seen in lunar breccias or deep drill cores represent conditions when more N-14 was available to the lunar surface.
Author

N86-28034*# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
NITROGEN AND NOBLE GASES IN THE 71501 BULK SOIL AND ILMENITE AS RECORDS OF THE SOLAR WIND EXPOSURE: WHICH IS CORRECT? **c91**
P. Signer, H. Baur, Ph. Etique, and R. Wieler *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 34-35 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

The N determination in mg sized mineral separates from lunar soils by static mass spectrometry is an experimental break-through likely to contribute to the deciphering of the records left in the mineral grains by the exposure to the solar wind. In this discussion some comparisons of the results of N and noble gas analyses of the 71501 bulk soil and an ilmenite separate thereof are focussed on. Conclusions from noble gas data obtained on mineral separates from some 20 soils are summarized in a companion paper and are also discussed herein.
Author

N86-28035*# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
STUDIES OF LIGHT NOBLE GASES IN MINERAL GRAINS FROM LUNAR SOILS: A STATUS REPORT **c91**
R. Wieler, Ph. Etique, and P. Signer *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 36-37 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

Among the lunar soil constituents, monomineralic grains deserve special attention. Noble gases of carefully prepared mineral separates from lunar bulk soils were studied. The major results and conclusions of these investigations are summarized, in the context of both the regolith evolution and the history of the solar corpuscular radiation. With regard to the most abundant noble gas component in the regolith samples (the solar gases) the mineral grains have mainly two properties giving these particles among all soil constituents the best characteristics as sensors for solar gases, despite the fact, that the noble gas concentrations in a mineral separate are 10 to 60 times lower that those in a bulk sample of the same grain size. The first of these properties is the mineral dependent retentivity of the light gases He and Ne, the second property concerns the relatively short time during which a mineral grain acquires it solar gases. These two points are briefly discussed.
Author

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N86-28036# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
OBSERVATIONS OF 3C273 WITH HIGH NORTH-SOUTH RESOLUTION
M. Cohen (California Inst. of Tech., Pasadena.), J. Biretta, R. E. Schaal, G. Comoretto (Instituto di Radioastronomia, Bologna (Italy).), L. Baath (Onsala Space Observatory (Sweden).), and G. Nicholson (National Inst. for Telecommunications Research, Johannesburg (South Africa).) Mar. 1986 3 p Submitted for publication
(INPE-3841-PRE/910) Avail: NTIS HC A02/MF A01

The first very long base interferometry (VLBI) results using high north-south resolution are presented for the quasar 3C273. A major result is that the VLBI jet does not have a simple monotonic curvature. The 11-GHz maps show new superluminal components about 1 milliarcsecond from the core at position angles between -140 and -120 deg. Comparison of these positions with those of components farther from the core shows that the VLBI jet first curves north and then south, and ultimately points to the optical jet.
M.G.

N86-28037*# Massachusetts Inst. of Tech., Cambridge.
COORDINATED OBSERVATIONS OF X-RAY BRIGHT BL LACERTAE OBJECTS Semiannual Status Report, 15 Mar. -

15 Sep. 1985
C. Megan Urry 1985 50 p refs
(Grants NAG5-495; NSF AST-83-01234)
(NASA-CR-177297; NAS 1.26:177297; SASR-1) Avail: NTIS HC A03/MF A01 CSCL 03A

Simultaneous multifrequency observations of the BL Lac object Mkn421 covering radio through X-ray wavelengths were performed. Composite multifrequency spectra of the central nonthermal component were obtained at the two epochs after subtracting the optical and infrared light of the underlying galaxy. Physical parameters of Mkn421 are discussed in terms of the synchrotron self-Compton model. Taking the spectral turnover between infrared and radio for synchrotrom self absorption, the radio emmision originates in a more extended region than the infrared to X-ray emission, the source size of which should be less than .01 milliarcseconds. Relativistic beaming is required if the angular size is smaller than a few times .001 milliarcseconds. A possible explanation of the spectral change during the two epochs is also discussed. B.G.

N86-28038*# Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.
A STUDY OF THE ULTRAVIOLET ABSORPTIONS IN THE SPECTRA OF DA WHITE DWARFS Semiannual Report, 1 Apr. - 30 Sep. 1985
Gary A. Wegner 10 Jun. 1986 14 p
(Grant NAG5-287)
(NASA-CR-177276; NAS 1.26:177276) Avail: NTIS HC A02/MF A01 CSCL 03A

Systematic investigations of the ultraviolet spectra of the hydrogen-rich white dwarfs were conducted with the International Ultraviolet Explorer satellite (IUE). This is to follow up on the work reported in Nelan and Wegner (1985) that the strong absorptions found earlier near lambda lambda 1600 and 1400 (cf. Greenstein 1980; Wegner 1982 and 1984, b) in the spectra of the cooler DA are absorptions produced by the H2 and H2(+) quasi-molecules. Observations of new DA white dwarfs obtained with the IUE are summarized. B.W.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N86-28039*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
MOLECULAR CLOUDS IN ORION AND MONOCEROS Ph.D. Thesis
Ronald J. Maddalena Jun. 1986 210 p
(NASA-TM-87786; NAS 1.15:87786) Avail: NTIS HC A10/MF A01 CSCL 03B

About one-eighth of a well-sampled 850 deg. sq. region of Orion and Monoceros shows CO emission coming from either local clouds (d < 1 kpc) lying as much as 25 deg. from the galactic plane or from more distant objects located within a few degrees of the plane. Local giant clouds associated with Orion A and B have enhanced temperatures and densities near their western edges possibly due to compression by a high pressure region created by approx.10 supernovae that occurred in the Orion OB association. Another giant cloud associated with Mon R2 may be related to the Orion clouds. Two filamentary clouds (one possibly 300 pc long but 10 pc wide) may represent a new class of object. An expanding ring of clouds concentric with the H II region ionized by lambda Ori probably constitute fragments of the original cloud from which lambda Ori formed; the gas pressure of the H II region and the rocket effect probably disrupted the original cloud. At a distance of 3 kpc, a large (250 x 100 pc) and massive (7-11x10 to the 5th power solar mass) cloud was found with the unusual combination of low temperatures (T sub R < 2.7 K) and wide spectral lines (approx. 7 km /sec). Most of the signs of star formation expected for such a massive cloud being absent, this may be a young cloud that has not yet started to form stars. The approx. 15 large clouds found in the outer galaxy (1 approx. 206 deg. - 220 deg.) probably lie in two spiral arms. The distribution of outer galaxy clouds and a comparison of the properties of these clouds and those of local clouds are given. Author

N86-27338# Ruhr Univ., Bochum (West Germany).
PLASMOIDS IN PLANETARY MAGNETIC FIELDS AND THE SOLAR CORONA
Karl Schindler *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 101-105 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

N86-28040*# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
LABORATORY EVALUATION AND APPLICATION OF MICROWAVE ABSORPTION PROPERTIES UNDER SIMULATED CONDITIONS FOR PLANETARY ATMOSPHERES Semiannual Status Report, 1 Feb. - 31 Jul. 1986
Paul G. Steffes 1986 20 p refs
(Grant NAGw-533)
(NASA-CR-177267; NAS 1.26:177267; SASR-5) Avail: NTIS HC A02/MF A01 CSCL 03B

The recognition of the need to make laboratory measurements of simulated planetary atmospheres over a range of temperatures and pressure which correspond to the altitudes probed by radio occultation experiments, and over a range of frequencies which correspond to both radio occultation experiments and radio astronomical observations, has led to the development of a facility at Georgia Tech which is capable of making such measurements. Construction was completed of the outer planets simulator and measurements were conducted of the microwave absorption and refraction from nitrogen under simulated Titan conditions. The results of these and previous laboratory measurements were applied to a wide range of microwave opacity measurements, in order to derive constituent densities and distributions in planetary atmospheres such as Venus. E.R.

N86-28041*# National Aeronautics and Space Administration, Washington, D.C.
ADVANCES IN PLANETARY GEOLOGY, VOLUME 1
Jul. 1986 579 p
(NASA-TM-88784-Vol-1; NAS 1.15:88784-Vol-1) Avail: NTIS HC A25/MF A01 CSCL 03B

This publication is a compilation of reports focusing on research into the origin and evolution of the solar system with emphasis on planetary geology. Author

N86-28042*# National Aeronautics and Space Administration, Washington, D.C.
ADVANCES IN PLANETARY GEOLOGY, VOLUME 2
Jul. 1986 475 p
(NASA-TM-88784-Vol-2; NAS 1.15:88784-Vol-2) Avail: NTIS HC A20/MF A01 CSCL 03B

This publication is a continuation of volume 1; it is a compilation of reports focusing on research into the origin and evolution of the solar system with emphasis on planetary geology. Specific reports include a multispectral and geomorphic investigation of the surface of Europa and a geologic interpretation of remote sensing data for the Martian volcano Ascreaus Mons. Author

N86-28022*# Houston Univ., Clear Lake, Tex.
PARTICLE TRACK MEASUREMENTS IN LUNAR REGOLITH BRECCIAS
George E. Blanford *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 14-16 Previously announced as A85-17791 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28023*# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
SCR AND GCR EXPOSURE AGES OF PLAGIOCLASE GRAINS FROM LUNAR SOIL
Ph. Etique, H. Baur, P. Signer, and R. Wieler *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 18-19 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28024*# Bern Univ. (Switzerland). Physikalisches Inst.
THE COMPOSITION OF LUNAR NOBLE GASES TRAPED 2.5 AE AND 3.5 AE AGO
O. Eugster *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Materials 1986 p 20 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28025*# Bern Univ. (Switzerland). Physikalisches Inst.
THE DATING OF PRE-EXPOSURE TIMES OF LUNAR ROCKS AND SOILS
O. Eugster *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 21 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28026*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
RELEASE OF NOBLE GASES AND NITROGEN FROM GRAIN-SURFACE SITES IN LUNAR ILMENITE BY CLOSED-SYSTEM OXIDATION
Urs Frick, Richard H. Becker, and R. O. Pepin *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 22-23 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28031*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PETROGRAPHIC SURVEY OF LUNAR REGOLITH BRECCIAS
D. S. McKay and Sue Wentworth (Lockheed Electronics Co., Houston, Tex.) *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 29-30 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28033*# Cambridge Univ. (England).
LUNAR NITROGEN: SECULAR VARIATION OR MIXING?
S. J. Norris, I. P. Wright, and C. T. Pillinger *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 32-33 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28034*# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
NITROGEN AND NOBLE GASES IN THE 71501 BULK SOIL AND ILMENITE AS RECORDS OF THE SOLAR WIND EXPOSURE: WHICH IS CORRECT?
P. Signer, H. Baur, Ph. Etique, and R. Wieler *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 34-35 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28035*# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
STUDIES OF LIGHT NOBLE GASES IN MINERAL GRAINS FROM LUNAR SOILS: A STATUS REPORT
R. Wieler, Ph. Etique, and P. Signer *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 36-37 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N86-28043# Stanford Univ., Calif. Center for Space Science and Astrophysics.
GEOMAGNETIC DISTURBANCES Final Report, 1 Sep. 1975 - 30 Sep. 1985
Philip H. Scherrer Jan. 1986 44 p
(Contract N00014-76-C-0207)
(AD-A165131) Avail: NTIS HC A03/MF A01 CSCL 03/2

Recent efforts include the study of the solar dynamics by directly observing the surface manifestations of giant scale convective motions. A knowledge of the structure of the convective zone is crucial to the eventual understanding of the solar magnetic cycle. The origin and structure of coronal magnetic fields and the origin of solar wind variability are studied. The static structure of the corona is governed by the large scale organization of photospheric fields. During times of low activity, these fields can be used to infer the coronal structure with reasonable accuracy. Our synoptic series of high accuracy low resolution magnetic observations continues to provide a useful source for a number of investigations conducted at Stanford and elsewhere. The relation between the effects of transient events and the large scale ambient structure is investigated. Flare accelerated material that does not cross the heliospheric current sheet has a larger impact on the terrestrial environment than material from flares that must cross the current sheet to arrive at the Earth. GRA

N86-28044*# National Geophysical Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 496, FEBRUARY 1986. PART 1: (PROMPT REPORTS). DATA FOR JANUARY 1986, DECEMBER 1985 AND LATE DATA
H. E. Coffey Feb. 1986 94 p
(Contract NASA Order W-15519; Grant NSF ATM-83-18491)
(NASA-CR-177319; NAS 1.26:177319; PB86-181336;
SGD-498-Pt-1) Avail: NTIS HC A05/MF A01 CSCL 03B

Solar-Geophysical Data Number 498, February 1986, Part 1 (Prompt Reports), Data for January 1986, December 1985 and Late Data contains the following:detailed index for 1985-86; data for January 1986--(IUWDS alert periods (advanced and world-wide), Solar activity indices, Solar flares, Solar radio emission, Vostok inferred interplanetary magnetic field polarity, Stanford mean solar magnetic field); data for December 1985--(Solar active regions, Sudden ionospheric disturbances, Solar radio spectral observations, Cosmic ray measurements by neutron monitor, Geomagnetic indices, Radio propagation indices); late data--(Solar radio emission Nancay interferometric chart December 1985, Solar radio spectral observations Culgoora May 1985, Geomagnetic indices sudden commencements November 1985, Calcium plage data). GRA

N86-28045*# National Geophysical Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 498, FEBRUARY 1986. PART 2: (COMPREHENSIVE REPORTS). DATA FOR AUGUST 1985, AND MISCELLANEA
H. E. Coffey Feb. 1986 31 p
(Contract NASA Order W-15519; Grant NSF ATM-83-18491)

(NASA-CR-177320; NAS 1.26:177320; PB86-181344; SGD-498-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 03B

Solar-Geophysical Data Number 498, February 1986, Part 2 (Comprehensive Reports), Data for August 1985, and Miscellenea contains the following: detailed index for 1985-86; data for August 1985--(Solar flares, Solar radio bursts at fixed frequencies, Solar X-ray radiation from GOES satellite, Mass ejections from the Sun, Active prominences and filaments); miscellaneous data--Meudon carte synoptique 13 May - 7 July 1985. Author (GRA)

N86-27331# Tromsoe Univ. (Norway). Auroral Observatory.
SOLAR WIND AND CORONAL HOLES
Egil Leer and Thomas E. Holzer (National Center for Atmospheric Research, Boulder, Colo.) *In* ESA Future Missions in Solar Heliospheric and Space Plasma Physics Jun. 1985 p 3-9 Sponsored by NSF (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27332# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
ENERGY INPUT INTO THE SOLAR WIND
E. Marsch *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 11-21 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27333# National Center for Atmospheric Research, Boulder, Colo. High Altitude Observatory.
THE CORONA AND INTERPLANETARY MEDIUM DURING THE SOLAR CYCLE
D. G. Sime *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 23-36 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27334# Bern Univ. (Switzerland). Inst. fuer Physik.
DIAGNOSTICS OF CORONA BY IN-SITU COMPOSITION MEASUREMENTS AT 1 AU
J. Geiss *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 37-50 Sponsored by Swiss National Science Foundation (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27335# Dartmouth Coll., Hanover, N.H.
SOLAR WIND INTERACTION WITH PLANETARY MAGNETIC FIELDS
B. U. O. Sonnerup *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 53-64 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27336# Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau (West Germany).
SOLAR WIND INTERACTION WITH NEUTRAL ATMOSPHERES
W.-H. Ip *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 65-82 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27342# Oxford Univ. (England). Dept. of Theoretical Physics.
HIGH RESOLUTION OBSERVATIONS OF MAGNETIC STRUCTURES
C. Jordan *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 161-167 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27343# Observatoire de Paris-Meudon (France).
SOLAR FINE STRUCTURES: THEIR IMPORTANCE IN THE SUN'S PHYSICS AND THEIR OBSERVATION
J. Heyvaerts *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 169-174 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27345# Cambridge Univ. (England). Inst. of Astronomy.
THEORY OF SOLAR OSCILLATIONS
D. O. Gough *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 183-197 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27346# National Optical Astronomy Lab. Tucson, Ariz. National Solar Observatory.
HIGH-RESOLUTION HELIOSEISMOLOGY
J. Harvey *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 199-208 Sponsored by NSF (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27347# Observatoire du Mont-Gros, Nice (France).
GLOBAL OSCILLATIONS
E. Fossat *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 209-217 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-27348# Observatoire de Paris-Meudon (France).
SOLAR/SPECTRA CONNECTIONS
F. Praderie *In* ESA Future Missions in Solar, Heliospheric and Space Plasma Physics Jun. 1985 p 219-228 (For primary document see N86-27330 18-12)
Avail: NTIS HC A12/MF A01

N86-28020*# California Univ., San Diego. Dept. of Chemistry.
SOLAR PARTICLE HISTORY: 1983 VERSION
J. R. Arnold, R. C. Reedy (Los Alamos National Lab., N. Mex.), and K. Nishiizumi *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 11 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28021*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
SOLAR WIND HELIUM, NEON AND ARGON RELEASED BY OXIDATION OF METAL GRAINS FROM THE WESTON CHONDRITE
R. H. Becker, R. S. Rajan (Jet Propulsion Lab., California Inst. of Tech., Pasadena.), and E. R. Rambaldi *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 12-13 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28027*# Washington Univ., St. Louis, Mo. Center for the Space Sciences.
BOUNDARY CONDITIONS ON THE EARLY SUN FROM ANCIENT COSMOGENIC NEON IN METEORITES
C. M. Hohenberg, M. W. Caffee, T. D Swindle, and J. Goswami (Physical Research Lab., Ahmedabad (India).) *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 24 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28028*# California Univ., Los Angeles. Inst. of Geophysics.
THE REALITY OF THE SECULAR CHANGE IN SOLAR WIND NITROGEN ISOTOPES
J. F. Kerridge *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 25 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28029*# Max-Planck-Inst. fuer Kernphysik, Heidelberg (West Germany).
DISTRIBUTION OF SOLAR WIND IMPLANTED NOBLE GASES IN LUNAR SAMPLES
J. Kiko and T. Kirsten *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 26-27 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28030*# Missouri Univ., Rolla. Dept. of Chemistry.
THE NEED FOR ISOTOPIC DATA ON REFRACTORY ELEMENTS IN THE SOLAR WIND
O. K. Manuel *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 28 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

N86-28032*# Physical Research Lab., Ahmedabad (India).
SOLAR FLARE NEON AND SOLAR COSMIC RAY FLUXES IN THE PAST USING GAS-RICH METEORITES
C. M. Nautiyal and M. N. Rao *In* Lunar and Planetary Inst. Workshop on Past and Present Solar Radiation: The Record in Meteoritic and Lunar Regolith Material 1986 p 31 (For primary document see N86-28019 18-88)
Avail: NTIS HC A03/MF A01 CSCL 03B

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N86-28046# Texas Univ., Austin.
THE IMPACT OF THE LOCAL ENVIRONMENT ON THE PROPERTIES OF RADIO GALAXIES: A STUDY OF GALAXIES IDENTIFIED FROM THE TEXAS SURVEY
Elizabeth Pike Bozyan 1985 514 p
Avail: Univ. Microfilms Order No. DA8527527

A sample of 3196 radio sources, with greater than or = 20 deg. from the +36 deg. strip of the 365 MHz Texas Survey, searched for optical counterparts, forms a large homogeneous data base used to investigate the incidence of and importance of, as a class of radio sources, optically first ranked galaxies occurring in small groups. The optical identification rate, for this sample, is 27%, with the identifications equally divided into red (galaxies) and blue ((QSO and QSO-like) objects. Statistical tests show that the galaxies and QSO plus QSO-like objects come from different radio populations and that their distribution of number as a function of apparent magnitude is different. Detailed optical and radio observations of a subset of twenty of the radio galaxies shows that the vast majority, probably all, are in interacting systems and that local environment plays a definite role. Divided by optical morphology, the combined optical luminosity of an interacting system is correlated with its radio luminosity. Examples taken from the literature confirm and extend these correlations to cluster radio galaxies. Using the sample of twenty to calibrate the entire sample of identified radio galaxies (405), a bivariate radioluminosity function has been constructed. By constructing a radio luminosity function covering three magnitudes in absolute optical magnitude, it is possible to explain the observed number of radio galaxies as a function of apparent magnitude without invoking luminosity or density evolution. The counts are explained by including a much larger number of intrinsically optically faint galaxies with large radio to optical luminosity ratios. Dissert. Abstr.

N86-28047*# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
AN INVESTIGATION OF THE ENERGY BALANCE OF SOLAR ACTIVE REGIONS USING THE ACRIM IRRADIANCE DATA
Semiannual Progress Report, May - Oct. 1985
Larry D. Petro 1986 10 p
(Contract NASw-4062)
(NASA-CR-176797; NAS 1.26:176797) Avail: NTIS HC A02/MF A01 CSCL 03B

The correlation between the irradiance (as measured by the Active Cavity Radiometer Irradiance Monitor and the Earth Radiation Budget) as corrected for sunspot flux deficit (which is responsible for most of the variance of the uncorrected signal) and both the 205 nm flux (as measured by Nimbus 7) and a photometric facular index is discussed. The computer program which simulates two-dimensional convection in a compressible, stratified medium is described. Equipment which was acquired to perform high precision, white-light observations of sunspot areas, and procedures were tested. Analysis of observations of large scale convective heat inhomogeneities which were obtained in May 1985 was begun. B.G.

99 GENERAL

No abstracts in this category.